

**POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
EXECUTIVE SUMMARY**

Fort Monmouth #1: Main Post NJ3210070597
Site Name CWA EPA Site ID Number
Tinton Falls, NJ 02-8410-36
Address TDD Number

SITE DESCRIPTION

The Main Post and Charles Wood Area (CWA) of the Ft. Monmouth military installation are located in Tinton Falls, NJ about 3 miles west of the coastal community of Long Branch. For the purpose of this evaluation the two posts are treated as one site. R & D in the areas of communications systems, electronics and surveillance, along with support activities has produced a wide variety of industrial and domestic waste on the installation.

The 8 landfills scattered across the site (7 on Main Post, 1 on CWA) contain unknown quantities of pesticide cans, batteries, asbestos, medicinal chemicals, STP sludge, etc. In addition, the sludge drying beds of both facilities' STP's are suspected of containing heavy metals and a variety of organic wastes from disposal in laboratory sinks and hoods.

There are several acres of wetlands along or within the boundaries of both posts. On-site streams and a man-made lake make the site conducive to surface migration of pollutants into the Shrewsbury River, a wide tidal estuary used primarily for recreation. The underlying Red Bank Aquifer is also in danger of contamination.

HAZARD RANKING SCORE: $S_m =$ $S_{gw} =$ $S_{sw} =$ $S_a = 0$
 $S_{fe} =$ $S_{dc} = 87.5$

Prepared by: Jay M. Crystall
of NUS Corporation

Date: 11/24/84

389423



Summary Statement
Fort Monmouth #1: Main Post and Charles Wood Area (CWA)
Tinton Falls, New Jersey

The Main Post and Charles Wood Area (CWA) of the Fort Monmouth military installation are located next to each other about three miles west of the coastal town of Long Branch. The two posts, which together occupy about 2½ square miles, include numerous laboratories, offices, housing units, and a hospital.

Since it was established as a permanent installation in 1925 a wide variety of R & D in communications systems, electronics and surveillance has been conducted. Industrial-type operations included metal plating, circuitboard etching, photoprocessing, and printing. Spent solvents, acids, and other wastes that were disposed of in laboratory hoods and sinks have collected on sludge drying beds in the sewerage treatment plants of both facilities. The beds are suspected of containing pollutants, primarily heavy metals and various organics.

Over the years, wastes generated at the site were disposed of in one of seven landfills on the Main Post and one on CWA. Although quantities and exact locations of materials are not known, the landfills contain a variety of domestic and industrial waste including pesticide cans, batteries, asbestos, medicinal chemicals, and sludge from the STP's.

There are several acres of wetlands along or within the boundaries of both facilities. Both posts are drained by streams that discharge into one of two tidal estuaries that border the site on the east. There is also a small man-made lake on CWA.

The unprotected nature of both the sludge drying beds and the landfills, along with the high water table, make the area prone to surface water contamination. If unchecked, this could possibly degrade the environmental quality of the recreational waters of the downstream Shrewsbury River, a wide tidal estuary. The same conditions arouse concern for groundwater contamination in the underlying Red Bank Aquifer. This could occur through either direct contact with the wastes or leaching through the sandy soil that underlies both installations.

As a government installation, Fort Monmouth is under the jurisdiction of the Department of Defense. A study based on observations, interviews, and review of records confirms the potential for surface and subsurface contamination and recommends further review.

Facility name: Fort Monmouth #1: Main Post & CWA

Location: Tinton Falls, Monmouth County, NJ

EPA Region: II

Person(s) in charge of the facility: U.S. Army Commander, Ft. Monmouth
Military Base.

Name of Reviewer: JAY M. Crystall Date: 11/24/84

General description of the facility:
 (For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

The Main Post and CWA area of Ft. Monmouth are located in Tinton Falls, N.J. about
3 miles west of Long Branch. The 2 posts are treated as one in this model. R & D in
electronics & communications systems, along with support activities have generated
a variety of industrial and domestic wastes landfills and sludge drying beds are
areas of concern. The geology of the area makes surface and subsurface migration
of pollutants very probable.

Scores: $S_M =$ ($S_{gw} =$ $S_{sw} =$ $S_a = 0$)
 $S_{FE} =$
 $S_{DC} = 87.5$

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet						
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)	
1 Observed Release	0 45	1	0	45	3.1	
If observed release is given a score of 45, proceed to line 4 . If observed release is given a score of 0, proceed to line 2 .						
2 Route Characteristics					3.2	
Depth to Aquifer of Concern	0 1 2 3	2	6	6		
Net Precipitation	0 1 2 3	1	2	3		
Permeability of the Unsaturated Zone	0 1 2 3	1	2	3		
Physical State	0 1 2 3	1	3	3		
Total Route Characteristics Score			13	15		
3 Containment	0 1 2 3	1	3	3	3.3	
4 Waste Characteristics					3.4	
Toxicity/Persistence	0 3 6 9 12 15 18	1	18	18		
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8		
Total Waste Characteristics Score				26		
5 Targets					3.5	
Ground Water Use	0 1 2 3	3	6	9		
Distance to Nearest Well/Population Served	0 4 8 12 16 18 20 24 30 32 35 40	1		40		
Total Targets Score				49		
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				57,330		
7 Divide line 6 by 57,330 and multiply by 100			S _{gw} =			

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet						
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)	
1 Observed Release	0 45	1	0	45	4.1	
If observed release is given a value of 45, proceed to line 4 . If observed release is given a value of 0, proceed to line 2 .						
2 Route Characteristics					4.2	
Facility Slope and Intervening Terrain	0 1 2 3	1	0	3		
1-yr. 24-hr. Rainfall	0 1 2 3	1	3	3		
Distance to Nearest Surface Water	0 1 2 3	2	6	6		
Physical State	0 1 2 3	1	3	3		
Total Route Characteristics Score			12	15		
3 Containment	0 1 2 3	1	3	3	4.3	
4 Waste Characteristics					4.4	
Toxicity/Persistence	0 3 6 9 12 15 18	1	18	18		
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8		
Total Waste Characteristics Score				26		
5 Targets					4.5	
Surface Water Use	0 1 2 3	3	6	9		
Distance to a Sensitive Environment	0 1 2 3	2	6	6		
Population Served/Distance to Water Intake Downstream	0 4 6 8 10 12 16 18 20 24 24 30 32 35 40	1	0	40		
Total Targets Score			12	55		
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5					64,350	
7 Divide line 6 by 64,350 and multiply by 100				S _{SW} =		

**FIGURE 7
SURFACE WATER ROUTE WORK SHEET**

Air Route Work Sheet						
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)	
1 Observed Release	0 45	1	0	45	5.1	
Date and Location:						
Sampling Protocol:						
If line 1 is 0, the $S_a = 0$. Enter on line 5 . If line 1 is 45, then proceed to line 2 .						
2 Waste Characteristics					5.2	
Reactivity and Incompatibility	0 1 2 3	1		3		
Toxicity	0 1 2 3	3		9		
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8		
Total Waste Characteristics Score				20		
3 Targets					5.3	
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30		
Distance to Sensitive Environment	0 1 2 3	2		6		
Land Use	0 1 2 3	1		3		
Total Targets Score				39		
4 Multiply 1 x 2 x 3				35,100		
5 Divide line 4 by 35,100 and multiply by 100				$S_a = 0$		

FIGURE 9
AIR ROUTE WORK SHEET

	S	S ²
Groundwater Route Score (S _{gw})	-	-
Surface Water Route Score (S _{sw})	-	-
Air Route Score (S _a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Fire and Explosion Work Sheet						
Rating Factor	Assigned Value (Circle One)	Multi- plier	Score	Max. Score	Ref. (Section)	
1 Containment	1 ③	1	3	3	7.1	
2 Waste Characteristics					7.2	
Direct Evidence	① 3	1	0	3		
Ignitability	0 1 2 ③	1	3	3		
Reactivity	0 1 2 ③	1	3	3		
Incompatibility	0 1 2 ④	1	3	3		
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8		
Total Waste Characteristics Score				20		
3 Targets					7.3	
Distance to Nearest Population	0 1 2 3 4 ⑤	1	5	5		
Distance to Nearest Building	0 1 2 ③	1	3	3		
Distance to Sensitive Environment	0 1 2 ③	1	3	3		
Land Use	0 1 2 ③	1	3	3		
Population Within 2-Mile Radius	0 1 2 3 4 ⑤	1	5	5		
Buildings Within 2-Mile Radius	0 1 2 3 4 ⑤	1	5	5		
Total Targets Score				24	24	
4 Multiply 1 x 2 x 3				1,440		
5 Divide line 4 by 1,440 and multiply by 100				SFE =		

FIGURE 11
FIRE AND EXPLOSION WORK SHEET

Direct Contact Work Sheet						
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)	
1 Observed Incident	0 45	1	0	45	8.1	
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2						
2 Accessibility	0 1 2 3	1	3	3	8.2	
3 Containment	0 15	1	15	15	8.3	
4 Waste Characteristics Toxicity	0 1 2 3	5	15	15	8.4	
5 Targets					8.5	
Population Within a 1-Mile Radius	0 1 2 3 4 5	4	16	20		
Distance to a Critical Habitat	0 1 2 3	4	12	12		
Total Targets Score			28	32		
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			18,900	21,600		
7 Divide line 6 by 21,600 and multiply by 100			SDC = 87.5			

**FIGURE 12
DIRECT CONTACT WORK SHEET**

FIT QUALITY ASSURANCE TEAM
DOCUMENTATION RECORDS
FOR
HAZARD RANKING SYSTEM

INSTRUCTIONS: As briefly as possible summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic-type reference. Include the location of the document.

FACILITY NAME: Fort Monmouth #1: Main Post and Charles Wood Area

LOCATION: Tinton Falls, New Jersey

DATE SCORED: 11/16/84

PERSON SCORING: Jay Crystall

PRIMARY SOURCE(S) OF INFORMATION (e.g., EPA region, state, FIT, etc.):

Installation Assessment of Fort Monmouth: Report #171, U.S. Army Toxic and Hazardous Materials Agency.

FACTORS NOT SCORED DUE TO INSUFFICIENT INFORMATION:

An indeterminate amount of the pollutants discussed in this summary are landfilled or have collected on sludge drying beds, the dimensions of which are unknown. Because of this the S_{gw} , S_{sw} , S_m , and S_{fe} were left unscored. The number of wells in the area and factors directly relating to it (i.e. distance to nearest well, population served by groundwater, etc.) were not used in the S_{gw} .

COMMENTS OR QUALIFICATIONS:

The S_{dc} score may misrepresent the actual potential for danger. There may be minute quantities of "high scoring" materials that may or may not react violently or produce toxic fumes, either alone or in combination. This ambiguity indicates a limited potential threat of explosion, fire, or exposure.

GROUNDWATER ROUTE

1 OBSERVED RELEASE

Contaminants detected (5 maximum):

No information on groundwater quality in the vicinity of the 2 facilities is available.

Rationale for attributing the contaminants to the facility:

Not applicable

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2 ROUTE CHARACTERISTICS

Depth to Aquifer of Concern

Name/description of aquifer(s) of concern:

The entire surface area of the Main Post and CWA may serve as a recharge area of the Red Bank Aquifer. The Red Bank Formation outcrops along the eastern and northeastern edges of the Main Post, just north of CWA. It is from 15-30 meters thick in the area of the posts.

Ref: #3, pp. 10, 17

Depth(s) from the ground surface to the highest seasonal level of the saturated zone water table(s) of the aquifer of concern:

0 ft. The water table is shallow on both posts. There are marshy areas occupying a large portion of CWA.

Ref: #3, pp. 10, 37

Depth from the ground surface to the lowest point of waste disposal/storage:

0 ft. Potential sources of contamination are from:

- 1) sludge drying beds in STP's of both installations and
- 2) a number of landfills scattered across both sites.

Ref: #3, pp. 29, 34, 47

Net Precipitation

Mean annual or seasonal precipitation (list months for seasonal):

46 inches

Ref: #1, p. 14

Mean annual lake or seasonal evaporation (list months for seasonal):

33 inches

Ref: #1, p. 13

Net precipitation (subcontract the above figures):

13 inches

Permeability of Unsaturated Zone

Soil type in unsaturated zone:

Soil in both areas is of the Freehold Series, a sandy loam or sandy clay loam.

Ref: #3, p. 14

Permeability associated with soil type:

Permeability ranges from 10^{-3} to 10^{-5} cm/sec

Ref: #1, p. 15

Physical State

Physical state of substances at time of disposal (or at present time for generated gases):

Liquids and sludges. A wide variety of domestic and industrial wastes including pesticide cans, batteries, asbestos, medicinal chemicals and STP sludge have been landfilled on the Main Post. There are seven landfills on the Main Post (1 is active) and one on CWA. There is an unlined asbestos waste pit containing pipe insulation, transite, etc. on the Main Post. In addition, laboratory wastes have collected on sludge drying beds in the STP's of both facilities.

Ref: #3, pp. 21-22, 28, 34, 39, 45

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3 CONTAINMENT

Containment

Method(s) of waste or leachate containment evaluated:

Open landfill with no liner or run-on control. The underdrained sludge drying beds on both facilities will be regarded as uncovered waste piles with leachate collection systems.

Ref: #1, p. 17

Ref: #3, pp. 28, 34, 39

Method with highest score:

Open landfill with no liner.

Ref: #1, p. 17

4 WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated:

Ferrocyanide	TCE	Carbon Tetrachloride
Formaldehyde	Dimethyl Sulfate	Tetrachloroethylene
Asbestos	Hydrazine	Xylene
Benzene	Hydroflouric Acid	Bromine
Chloroform	Sulfuric Acid	

Various heavy metal salts inherent in plating wastes

Ref: #3, pp. 3, C7-C9, E4-E-10

Compound with highest score:

Carbon tetrachloride

Chloroform

Ref: #1, p. 20

Ref: #4, p. 471, 493

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (Give a reasonable estimate even if quantity is above maximum):

Unknown. No data pertaining to the dimensions of either the landfills or sludge drying beds is available.

Basis of estimating and/or computing waste quantity:

Not applicable

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5 TARGETS

Groundwater Use

Use(s) of aquifer(s) of concern within a 3-mile radius of the facility:

The Red Bank Aquifer was at one time a source for many domestic wells in the area. The number of wells in use today is unknown.

Ref: #3, p. 12

Distance to Nearest Well

Location of nearest well drawing from aquifer of concern or occupied building not served by a public water supply:

Information not available.

Distance to above well or building:

Not applicable

Population Served by Groundwater Wells Within a 3-Mile Radius

Identified water-supply well(s) drawing from aquifer(s) of concern within a 3-mile radius and populations served by each:

Unknown. (Monmouth County Water Works uses upgradient springs about 2½ miles north of the Charles Wood Area.)

Ref: #2

Computation of land area irrigated by supply well(s) drawing from aquifer(s) of concern within a 3-mile radius, and conversion to population (1.5 people per acre).

Not applicable

Total population served by groundwater within a 3-mile radius:

Not applicable

SURFACE WATER ROUTE

1 OBSERVED RELEASE

Contaminants detected in surface water at the facility or downhill from it (5 maximum):

No observed release.

Rationale for attributing the contaminants to the facility:

Not applicable

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2 ROUTE CHARACTERISTICS

Facility Slope and Intervening Terrain

Average slope of facility in percent:

Both posts lie on relatively flat terrain (slopes 1%)

Ref: #2

Name/description of nearest downslope surface water:

The Wampum Creek receives most of the runoff from CWA. It combines with an unnamed tributary to the north and forms Wampum Lake, a small freshwater pond. Wampum Lake is the source for Mill Brook which combines with the Lafetra Brook in the Main Post and forms Parkers Creek. The Husky Brook enters the Main Post from the south, flows through the man-made Husky Brook Lake, and drains into Oceanport Creek. Both Oceanport Creek and Parkers Creek are tidal estuaries.

Ref: #2

Ref: #3, pp. 14, 36-37, 40

Average slope of terrain between facility and above-cited surface water body in percent:

Average slope is < 2%

Ref: #2

Is the facility located either totally or partially in surface water?

Yes. The man-made Husky Brook Lake is in the Main Post. Parkers Creek and Oceanport Creek are 2 tidal estuaries that join together and form part of the eastern border of the Main Post facility. Much of CWA lies on wetlands.

Ref: #2

Ref: #3, pp. 21, 40

Is the facility completely surrounded by areas of higher elevation?

No. Much of the surrounding terrain is relatively flat.

Ref: #2

1-Year 24-Hour Rainfall in Inches

4 inches

Ref: #1, p. 33

Distance to Nearest Downslope Surface Water

0 ft. Parkers Creek and Oceanport Creek border the Main Post. Husky Brook Lake is within the boundaries of CWA and Wampum Lake is just to the east.

Ref: #2

Ref: #3, p. 40

Physical State of Waste

Liquids and sludges. Landfills contain a variety of domestic and industrial wastes including pesticide cans, asbestos, batteries, medicinal chemicals and STP sludge. Also, heavy metal salts inherent in waste from electroplating operations may have collected on sludge drying beds in both posts. In addition, there is an unlined asbestos waste pit on the Main Post.

Ref: #3, pp. 21, 22, 34, 45

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3 CONTAINMENT

Containment

Method(s) of waste or leachate containment evaluated:

7 landfills are scattered across the Main Post (only 1 is active) and 1 on CWA. All are less than 200 ft. from the banks of streams. Sludge drying beds in CWA's STP are adjacent to marshy areas.

Ref: #3, p. 36, 37

Method with highest score:

Uncovered, unlined landfills and uncovered waste piles with no runoff diversion system.

Ref: #1, p. 35

4 WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated

Ferrocyanide	TCE	Carbon tetrachloride
Formaldehyde	Dimethyl sulfate	Xylene
Asbestos	Hydrazine	Bromine
Benzene	Hydrofluoric acid	
Chloroform	Sulfuric acid	
Various heavy metal salts		

Ref: #3, pp. 33, C7-C9, E4-E10

Compound with highest score:

Carbon tetrachloride
Chloroform
Ref: #1, p. 20

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (Give a reasonable estimate even if quantity is above maximum):

Unknown. No data pertaining to the dimensions of the landfills or sludge drying beds is available.

Basis of estimating and/or computing waste quantity:

Not applicable

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5 TARGETS

Surface Water Use

Use(s) of surface water within 3 miles downstream of the hazardous substance:

Parkers Creek and Oceanport Creek are branches of the Shrewsbury River, a wide tidal estuary that extends for about 3 miles inland from the Atlantic Ocean.

The Shrewsbury River is used for boating, swimming, fishing, clamming, etc.

Ref: #2

Is there tidal influence?

Yes. Both Parkers Creek and Oceanport Creek are tidal estuaries whose water quality is controlled more by tidal action than by entering freshwater (mean ocean tide is 4 ft.)

Ref: #2

Ref: #3, p. 40

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

0 ft. Both posts of Ft. Monmouth have a floodplain salt marsh either within or along their boundaries.

Ref: #3, p. 3

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

There are some freshwater marshes about 3/4 mile west of CWA.

Ref: #2

Distance to critical habitat of an endangered species or national wildlife refuge, if 1 mile or less:

0 ft. Parkers Creek is a designated wildlife habitat.

Ref: #3, p. 3

Population Served by Surface Water

Location(s) of water-supply intake(s) within 3 miles (free-flowing bodies) or 1 mile (static water bodies) downstream of the hazardous substance and population served by each intake:

There are no downstream intakes. The Swimming River Reservoir is used as a source for many neighboring municipalities. It lies 2 miles to the west and is hydrologically separated from the post by Pine Brook and areas of higher elevation.

Ref: #2

Computation of land area irrigated by above-cited intake(s) and conversion to population (1.5 people per acre):

0

Total population served:

0

Name/description of nearest of above water bodies:

Not applicable

Distance to above-cited intakes, measured in stream miles.

Not applicable

AIR ROUTE

1 OBSERVED RELEASE

Contaminants detected:

None detected

Date and location of detection of contaminants

N/A

Methods used to detect the contaminants:

N/A

Rationale for attributing the contaminants to the site:

N/A

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2 WASTE CHARACTERISTICS

Reactivity and Incompatibility

Most reactive compound:

N/A

Most incompatible pair of compounds:

N/A

Toxicity

Most toxic compound:

N/A

Hazardous Waste Quantity

Total quantity of hazardous waste:

N/A

Basis of estimating and/or computing waste quantity:

N/A

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3 TARGETS

Population Within 4-Mile Radius

Circle radius used, give population, and indicate how determined:

0 to 4 mi

0 to 1 mi

0 to 1/2 mi

0 to 1/4 mi

N/A

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

N/A

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

N/A

Distance to critical habitat of an endangered species, if 1 mile or less:

N/A

Land Use

Distance to commercial/industrial area, if 1 mile or less:

N/A

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:

N/A

Distance to residential area, if 2 miles or less:

N/A

Distance to agricultural land in production within past 5 years, if 1 mile or less:

N/A

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:

N/A

Is a historic or landmark site (National Register or Historic Places and National Natural Landmarks) within the view of the site?

N/A

FIRE AND EXPLOSION

1 CONTAINMENT

Hazardous substances present:

Ferrocyanide	TCE	Carbon tetrachloride
Formaldehyde	Dimethyl sulfate	Xylene
Asbestos	Hydrazine	Bromine
Benzene	Hydroflouric acid	
Chloroform	Sulfuric acid	
Various heavy metal salts		

Ref: #3, pp. 33, C7-C9, E4-E10

Type of containment, if applicable:

Uncovered, unlined landfills and waste piles.

Ref: #1, p. 17

Ref: #3, pp. 34-37

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2 WASTE CHARACTERISTICS

Direct Evidence

Type of instrument and measurements:

No data available

Ignitability

Compound used:

Xylene, Benzene, Hydrazine

Ref: #1, p. 20

Ref: #4, pp. 726

Reactivity

Most reactive compound:

Hydrazine

Sulfuric Acid

Ref: #1, p. 20

Ref: #4, p. 726

Incompatibility

Most incompatible pair of compounds:

Many of the substances present (including bromine and hydroflouric acid) when combined with water or a reducing agent (like hydrazine) may react violently and/or produce highly toxic and corrosive fumes. Carbon tetrachloride may release phosgene. Ferrocyanides may release hydrogen cyanide gas.

Ref: #4, pp. 493, 471, 431

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Hazardous Waste Quantity

Total quantity of hazardous substances at the facility:

Not enough information available to provide a reliable estimate of waste quantity.

Basis of estimating and/or computing waste quantity:

Not applicable

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3 TARGETS

Distance to Nearest Population

50 ft. Military personnel reside on both posts. Less than 200 ft from potentially contaminated areas on Main Post to houses on Rt. 35 and neighborhood of Broad Street.

Ref: #2

Ref: #3, p. 21

Distance to Nearest Building

50 ft to buildings on base and less than 200 ft to above mentioned neighborhoods.

Ref: #2

Ref: #3, p. 21

Distance to Sensitive Environment

Distance to wetlands:

0 ft. In addition to the floodplain salt marshes on both posts, Parkers Creek, which borders the Main Post, is a designated wildlife habitat.

Ref: #2

Ref: #3, pp. B2-B4, 3, 37

Distance to critical habitat:

0 ft. A sludge dump on the CWA facility is adjacent to swampy areas.

Ref: #3, pp. 3, 37

Land Use

Distance to commercial/industrial area, if 1 mile or less:

0 ft. The site of an inactive, off-base landfill along Rt. 35 is now developed.

Ref: #2

Ref: #3, p. 21

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:

0 ft. Parkers Creek is a designated wildlife habitat.

Ref: #2

Ref: #3, p. 3

Distance to residential area, if 2 miles or less:

50 ft. Military personnel reside on both bases.

Ref: #3, p. 21, 23, 36, 37

Distance to agricultural land in production within past 5 years, if 1 mile or less:

Information not available.

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:

Information not available.

Is a historic or landmark site (National Register or Historic Places and National Natural Landmarks) within the view of the site?

None within view.

Ref: #2

Population Within 2-Mile Radius

Estimated to be >20,000

Ref: #2

Ref: #5

Buildings Within 2-Mile Radius

Estimated to be >7,000

Ref: #2

Ref: #5

DIRECT CONTACT

1 OBSERVED INCIDENT

Date, location, and pertinent details of incident:

None recorded

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2 ACCESSIBILITY

Describe type of barrier(s):

Landfills, both active and inactive, are unprotected and easily accessible to on-site personnel. STP's are fenced off.

Ref: #3, pp. 36, 37, A4, A8, A11, A13, A16

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3 CONTAINMENT

Type of containment, if applicable:

Landfills are uncovered waste piles.

Ref: #3, pp. 28, 29, 34, 39

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4 WASTE CHARACTERISTICS

Toxicity

Compounds evaluated:

Ferrocyanide	TCE	Carbon tetrachloride
Formaldehyde	Dimethyl sulfate	Xylene
Asbestos	Hydrazine	Bromine
Benzene	Hydroflouric acid	
Chloroform	Sulfuric acid	

Various heavy metal salts

Ref: #3, pp. 33, C7-C9, E4-E10

Compound with highest score:

Nitric acid, sulfuric acid, hydroflouric acid, carbon tetrachloride, bromine

Ref: #1, p. 20

Ref: #4, pp. 431, 471, 729

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17

5 TARGETS

Population Within One-Mile Radius

Estimated to be >5000

Ref: #2

Ref: #5

Distance to Critical Habitat (of Endangered Species)

0 ft. There are floodplain salt marshes on both installations that sustain a few endangered species.

Ref: #2

Ref: #3, pp. B2-B4, 3, 36, 37

BIBLIOGRAPHY OF INFORMATION SOURCES

HRS MODEL

SOURCE	LOCATION
1. HRS User's Manual	NUS FIT II, Edison, NJ.
2. USGS Topographical Map - Long Branch, NJ Quadrangle	NUS FIT II, Edison, NJ.
3. <u>Installation Assessment of Ft. Monmouth: Report No. 171</u> , U.S. Army Toxic and Hazardous Materials Agency	NUS FIT II, Edison, NJ.
4. Sax, N. Irving, <u>Dangerous Properties of Industrial Materials</u> , 5th edition	NUS FIT II, Edison, NJ.
5. Population Estimates for New Jersey, July 1, 1982, Office of Demographic and Economic Analysis.	NUS FIT II, Edison, NJ.

erythema and burning, and, in more severe cases, edema and even blistering. Exposure to high conc of the vapor (3000 ppm or higher) may result from failure of equipment or spillage. Such exposure, while rare in industry, may result in acute poisoning, characterized by the narcotic action of benzene on the CNS. The anesthetic action of benzene is similar to that of other anesthetic gases, consisting of a preliminary stage of excitation followed by depression and, if exposure is continued, death through respiratory failure. The chronic, rather than the acute form, of benzene poisoning is important in industry. It is a recog leukemogen. [14, 3, 1, 102] There is no specific blood picture occurring in cases of chronic benzol poisoning. The bone marrow may be hypoplastic, normal, or hyperplastic, the changes reflected in the peripheral blood. Anemia, leucopenia, macrocytosis, reticulocytosis, thrombocytopenia, high color index, and prolonged bleeding time may be present. Cases of myeloid leukemia have been reported. For the supervision of the worker, repeated blood examinations are necessary, including hemoglobin determinations, white and red cell counts and differential smears. Where a worker shows a progressive drop in either red or white cells, or where the white count remains below 5,000 per cu mm or the red count below 4.0 million per cu mm, on two successive monthly examinations, he should be immediately removed from exposure. Following absorption of benzene, elimination is chiefly through the lungs, when fresh air is breathed. The portion that is absorbed is oxidized, and the oxidation products are combined with sulfuric and glycuronic acids and eliminated in the urine. This may be used as a diagnostic sign. Benzene has a definite cumulative action, and exposure to relatively high conc is not serious from the point of view of causing damage to the blood-forming system, provided the exposure is not repeated. On the other hand, daily exposure to conc of 100 ppm or less will usually cause damage if continued over a protracted period of time. In acute poisoning, the worker becomes confused and dizzy, complains of tightening of the leg muscles and of pressure over the forehead, then passes into a stage of excitement. If allowed to remain in exposure, he quickly becomes stupefied and lapses into coma. In non-fatal cases, recovery is usually complete and no permanent disability occurs. In chronic poisoning the onset is slow, with the symptoms vague; fatigue, headache, dizziness, nausea and loss of appetite, loss of weight and weakness are common complaints in early cases. Later, pallor, nosebleeds, bleeding gums, menorrhagia,

petechiae and purpura may develop. There is individual variation in the signs and symptoms of chronic benzene poisoning. Benzene is a common air contaminant.

Fire Hazard: Dangerous, when exposed to flame; can react vigorously with oxidizing materials, such as BrF_3 , Cl_2 , CrO_3 , O_2NClO_4 , perchlorates, $(\text{AlCl}_3 + \text{FCIO}_4)$, $(\text{H}_2\text{SO}_4 + \text{perganates})$, K_2O_2 , $(\text{AgClO}_4 + \text{acetic acid})$, [19]

Spont Heating: No.

Explosion Hazard: Mod, when its vapors are exposed to flame. Use with adequate ventilation.

Disaster Hazard: Dangerous, highly flammable.

To Fight Fire: Foam, CO_2 , dry chemical.

BENZENE ARSONIC ACID. See phenyl arsonic acid.

BENZENE CARBONYL CHLORIDE. See benzoyl chloride.

1,3-BENZENEDIOL. See resorcinol.

BENZENE DIAZOANILIDE. See β -diazoaniline.

BENZENE DIAZONIUM-2-CARBOXYLATE DROCHLORIDE. $\text{C}_7\text{H}_4\text{O}_2\text{N}_2 \cdot \text{HCl}$, mw: 184.

THR = No toxicity data. Very unstable in dry state.

BENZENE DIAZONIUM CHLORIDE. See benzene chloride.

BENZENE DIAZONIUM CHROMATE. See benzene chromate.

BENZENE DIAZONIUM NITRATE. See benzene nitrate.

1,3-BENZENE DICARBONITRILE. See *o*-diisocyanobenzene.

BENZENE DICARBOXYLIC ACID. See phthalic acid.

1,2-BENZENE DIOL. See pyrocatechol.

1,4-BENZENE DIOL. See hydroquinone.

BENZENE-1,3-DIPHENYL. See *m*-terphenyl.

BENZENE-1,4-DIPHENYL. See *p*-terphenyl.

***m*-BENZENEDISULFONIC ACID.** Syn: *M*. Gray crystalline hygroscopic powder. $\text{C}_6\text{H}_6\text{O}_6\text{S}_2$ 238.23.

THR = HIGH irr to skin, eyes and mu mem. In solution it forms an extremely corrosive liquid.

Disaster Hazard: Dangerous; see sulfonates.

BENZENE HEXACHLORIDE. See hexachlorocyclohexane.

BENZENE PHOSPHONIC ACID. Colorless crystals. $\text{C}_6\text{H}_5\text{PO}(\text{OH})_2$, mw: 158.1, mp: 165°, d: 1.475. **THR** = U.

HYDRAZO BENZENE. $C_{12}H_{12}N_2$, mw: 184.3.

THR = HIGH via oral. An exper neo. [3]

HYDRAZO DICARBOXY BIS (METHYL NITROSAMIDE).

THR = An exper carc. [23]

HYDRAZOIC ACID. Syns: *azoimide*, *hydrogen azide*.

Colorless liquid, very sol in water, intolerable pungent odor. HN_3 , mw: 43.02, mp: -80° , bp: 37° , d: 1.09 @ $25^\circ/4^\circ$.

Acute tox data: Inhal LC_{LO} (rat) = 1100 ppm for 1 hr; ip LD_{50} (mouse) = 22 mg/kg; inhal TC_{LO} (human) = 0.3 ppm \rightarrow CNS problems.

THR = HIGH irr to skin, eyes and mu mem and via oral and inhal routes. Exposures to vapors causes irr of the eyes and mu mem. Continued inhal causes cough, chills and fever. High conc can cause fatal convulsions. Chronic exposure has been reported as causing injury to kidneys and spleen.

Explosion Hazard: Dangerous, when shocked or exposed to heat. Reacts violently with Cd, Cu, Ni, HNO_3 , F_2 . [19]

Disaster Hazard: Dangerous; shock or heat will explode it.

HYDRIDES.

THR = Variable. The hydrides of phosphorus, arsenic, sulfur, selenium, tellurium and boron which are of HIGH toxicity produce local irr and destroy red blood cells. They are particularly dangerous because of their volatility and ease of entry into the body. The hydrides of the alkali metals, alkaline earths, aluminum, zirconium and titanium react with moisture to evolve hydrogen and leave behind the hydroxide of the metallic element. This hydroxide is usually caustic. See also sodium hydroxide. Hydrides, metallic, primary type.

This group includes the hydrides of calcium, lithium, magnesium, potassium, sodium and strontium. In the presence of moisture they are readily converted to hydroxides which are highly irr to the skin by caustic and thermal action. Similar effects can occur on contact with eyes and respiratory mu mem.

Fire Hazard: The volatile hydrides are flam, some spont so in air. All hydrides react violently on contact with powerful oxidizing agents. When heated or on contact with moisture or acids an exothermic reaction evolving hydrogen occurs. Often enough heat is evolved to cause ignition. Hydrides require special handling instructions which should be obtained from the manufacturers (Section 7).

Explosion Hazard: The volatile hydrides (such as hydrides of boron, arsenic, phosphorus, selenium,

tellurium) form explosive mixtures with air. The nonvolatile hydrides (such as sodium, lithium, calcium) readily liberate hydrogen when heated or on contact with moisture or acids. Furthermore, hydrides form dust clouds which can explode due to contact with flames, sparks, heat or oxidizers.

Disaster Hazard: Highly dangerous; when heated, they can ignite at once or liberate hydrogen: they react with moisture or acids to evolve heat and hydrogen; on contact with powerful oxidizers violent reactions can occur.

HYDRIODIC ACID. Colorless gas or pale yellow liquid. HI, mw: 127.93, mp: -50.8° , bp: -35.38° @ 5 atm, d: 5.66g/liter @ 0° .

THR = HIGH irr to skin, eyes and mu mem and via oral and inhal routes. Violent reaction with F_2 , ($HClO_4 + Mg$), HNO_3 , O_3 , K, $KClO_3$. [19]

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic fumes of iodides; will react with water or steam to produce toxic and corrosive fumes.

HYDRIODIC ETHER. See ethyl iodide.

HYDROABIETYL ALCOHOL. Syn: *abitol*. Colorless, tacky, viscous liquid. Mixture of tetra-, di- and dehydroabietyl alcohols. Flash p: $380^\circ F$ (OC), d: 1.007-1.008 @ $20^\circ/20^\circ$, softening p: 33° .

THR = Limited animal exper indicate LOW order.

Fire Hazard: Slight, when exposed to heat or flame; can react with oxidizing materials.

To Fight Fire: Foam, CO_2 , dry chemical.

HYDROBROMIC ACID. Syn: *hydrogen bromide*. Colorless gas or pale yellow-liquid. HBr, mw: 80.92, mp: -87° , bp: -66.5° , d: 3.50 g/liter @ 0° .

Acute tox data: Inhal LC_{50} (mouse) = 814 ppm for 1 hr; inhal LC_{50} (rat) = 2858 ppm for 1 hr; inhal TC_{LO} (human) = 5 ppm \rightarrow irr. [3]

THR = HIGH irr and via oral and inhal routes. Reacts violently with F_2 , NH_3 , O_3 . [19]

Disaster Hazard: Dangerous; see bromides; will react with water or steam to produce toxic and corrosive fumes.

HYDROBROMIC ETHER. See ethyl bromide.

HYDROCARBON GAS, LIQUEFIED. See specific gas.

HYDROCARBON GAS, NONLIQUEFIED. See specific material.

HYDROCHLORIC ACID. Syns: *muratic acid*, *chlorohydric acid*, *hydrogen chloride*. Colorless gas or colorless fuming liquid, strongly corrosive. HCl, mw: 36.47, mp: -114.3° , bp: -84.8° , d: 1.639 g/liter (gas) @ 0° , 1.194 @ -26° (liquid), vap. press: 4.0 atm @ 17.8° . Acute tox data: Oral LD_{50} (rabbit) = 900 mg/kg; inhal

LC₅₀ (rat) = 3124 ppm for 1 hr; inhal LC_{LO} (human) = 1300 ppm for ½ hr. [3]

THR = MOD irr to skin, eyes and mu mem and via oral and inhal routes. Hydrochloric acid is an irr to the mu mem of the eyes and respiratory tract, and a conc of 35 ppm causes irr of the throat after short exposure. Conc of 50–100 ppm are tolerable for 1 hr. More severe exposures result in pulmonary edema, and often laryngeal spasm. Conc of 1,000–2,000 ppm are dangerous, even for brief exposures. Mists of hydrochloric acid are considered less harmful than the anhydrous hydrogen chloride, since the droplets have no dehydrating action. In general, hydrochloric acid causes little trouble in industry, other than from accidental splashes and burns. It is used as a general purpose food additive. [109] It is a common air contaminant. Violent reactions with acetic anhydride, 2-amino ethanol, NH₄OH, Ca₃P₂, chlorosulfonic acid, ethylene diamine, ethylene imine, oleum, HClO₄, β-propiolactone, propylene oxide, (AgClO₄ + CCl₄), NaOH, H₂SO₄, U₃P₄, vinyl acetate. [19] Also CaC₂, CsC₂H, Cs₂C₂, Li₆Si, Mg₃B₂, HgSO₄, RbC₂H, Rb₂C₂, Na. [19]

Disaster Hazard: Dangerous; see chlorides; will react with water or steam to produce toxic and corrosive fumes.

HYDROCHLORIC ACID MIXTURES. See hydrochloric acid.

HYDROCHLORIC ETHER. See ethyl chloride.

HYDROCERUSSITE. See lead carbonate, basic.

HYDROCORTISONE ACETATE. White, odorless, crystalline powder, very slightly sol in ether, practically insol in water, slightly sol in alcohol and chloroform. C₂₃H₃₂O₆, mw: 404, mp: 216°–233°.

Acute tox data: Ip LD₅₀ (mouse) = 2300 mg/kg. [3]

THR = MOD via ip route. Used as a food additive permitted in food for human consumption. [109]

HYDROCORTISONE SODIUM SUCCINATE.

White, odorless, hygroscopic, amorphous solid, very sol in water and alcohol, insol in chloroform, very slightly sol in acetone. C₂₅H₃₃NaO₈, mw: 484.5, mp: 169°–171°.

THR = Details U. Used as a food additive permitted in food for human consumption. [109]

HYDROCOTARNINE. Monoclinic prisms.

C₁₂H₁₅NO₃ · ½H₂O, mw: 230.3, mp: 56°.

THR = An alkaloid obtained by reducing cotarnine. Made from the poppy.

Disaster Hazard: Dangerous; when heated to decomp, can emit highly toxic fumes of nitrogen compounds.

HYDROCYANIC ACID (96%). Syns: *hydrogen cya-*

nide, prussic acid. Colorless liquid, faint odor of bitter almonds. HCN, mw: 27.03, mp: -13.2°, bp: 25.7°, lel = 5.6%, uel = 40%, flash p: 0°F (CC), d: 0.6876 @ 20°/4°, autoign. temp.: 1000°F, vap. press: 400 mm @ 9.8°, vap. d: 0.932.

Acute tox data: Oral LD_{LO} (human) = 0.57 mg/kg; inhal LC_{LO} (human) = 120 mg/m³ for 1 hr; inhal LC_{LO} (human) = 200 mg/m³ for 10 min; iv LD₅₀ (human) = 1 mg/kg; inhal LC₅₀ (rat) = 544 ppm for 5 min; oral LD₅₀ (mouse) = 3.7 mg/kg; ip LD₅₀ (mouse) = 3 mg/kg; im LD₅₀ (rabbit) = 1.1 mg/kg. [3]

THR = VERY HIGH via oral, dermal, inhal, iv, ip and im routes. Hydrocyanic acid and the cyanides are true protoplasmic poisons, combining in the tissues with the enzymes associated with cellular oxidation. They thereby render the oxygen unavailable to the tissues, and cause death through asphyxia. The suspension of tissue oxidation lasts only while the cyanide is present; upon its removal, normal function is restored provided death has not already occurred. Hydrocyanic acid does not combine easily with hemoglobin, but it does combine readily with methemoglobin to form cyanmethemoglobin. This fact is utilized in the treatment of cyanide poisoning, when an attempt is made to induce methemoglobin formation. The presence of cherry-red venous blood in cases of cyanide poisoning is due to the inability of the tissues to remove the oxygen from the blood. Exposure to conc of 100–200 ppm for periods of 30–60 min can cause death.

In cases of acute cyanide poisoning, death is extremely rapid; though sometimes breathing may continue for a few minutes. In less acute cases, there is headache, dizziness, unsteadiness of gait, a feeling of suffocation, and nausea. Where the patient recovers, there is rarely any disability. An insecticide.

Fire Hazard: Very dangerous, when exposed to heat, flame or oxidizers. Can polymerize @ 50°–60°, or catalyze with traces of alkali. Reacts violently with acetaldehyde.

Explosion Hazard: Severe, when exposed to heat or flame or by chemical reaction with oxidizers. Under certain conditions, particularly contact with alkaline materials, hydrogen cyanides can polymerize or decomp explosively. The liquid is commonly stabilized by addition of acids.

Disaster Hazard: Highly dangerous; the gas forms explosive mixtures with air; will react with water, steam, acid or acid fumes to produce highly toxic fumes of cyanides.

To Fight Fire: CO₂, non-alkaline dry chemical, foam

CARBON SULFIDE TELLURIDE. Yellow-red crystals. CSt_e. mw: 171.69, mp: > -54°, bp: decomp -54.0°, d: 2.9 @ 50°.

THR = See carbon disulfide, tellurium compounds and sulfides.

CARBON TETRABROMIDE. Syn: *tetrabromomethane*. Colorless monoclinic tablets. CBr₄, mw: 331.67, mp: α 48.4°, β 90.1°, bp: 189.5°, d: 3.42, vap. press: 40 mm @ 96.3°.

Acute tox data: sc LD₅₀ (mouse) = 298 mg/kg; oral LD₅₀ (rat) = 1 g/kg. [3]

THR = HIGH via sc and MOD via oral routes. Severe reaction with Li. [19] Narcotic in high conc.

Disaster Hazard: See chlorinated HC, aliphatic.

CARBON TETRACHLORIDE. Syn: *tetrachloromethane*. Colorless liquid, heavy, ethereal odor. CCl₄, mw: 153.84, mp: -22.6°, bp: 76.8°, fp: -22.9°, flash p: none, d: 1.597 @ 20°, vap. press: 100 mm @ 23.0°.

Acute tox data: Oral LD₅₀, (rat) = 1770 mg/kg; ip LD₅₀ (rat) = 1500 mg/kg; inhal LC₅₀ (mouse) = 9526 ppm for 8 hrs; oral LD₅₀ (humans) = 60 mg/kg; inhal TC_{Lo} (humans) = 20 ppm → CNS effects. [3]

THR = MOD via oral, in and inhal; HIGH via human oral and inhal routes. Carbon tetrachloride has a narcotic action resembling that of chloroform, though not as strong. Following exposures to high conc, the victim may become unconscious, and if exposure is not terminated, death can follow from respiratory failure. In cases of narcosis that recover, the after-effects are more serious than those of delayed chloroform poisoning, usually taking the form of damage to the kidneys, liver and lungs. Exposure to lower conc, insufficient to produce unconsciousness, usually results in severe gastro-intestinal upset, and may progress to serious kidney and hepatic damage. The kidney lesion is an acute nephrosis; the liver involvement consists of an acute degeneration of the central portions of the lobules. Where recovery takes place, there may be no permanent disability. Marked variation in individual susceptibility to carbon tetrachloride exists, some persons appear to be unaffected by exposures which seriously poison their fellow-workers. Alcoholism and previous liver and kidney damage seem to render the individual more susceptible. Conc of the order of 1,000 to 1,500 ppm are sufficient to cause symptoms if exposure continues for several hours. Repeated daily exposure to such conc may result in poisoning.

Though the common form of poisoning following industrial exposure is usually one of gastro-intestinal upset, which may be followed by renal

damage, other cases have been reported in which the CNS has been affected with production of polyneuritis, narrowing of the visual fields, and other neurological changes. Prolonged exposure to small amounts of carbon tetrachloride has also been reported as causing cirrhosis of the liver.

Locally, a dermatitis may be produced following long or repeated contact with the liquid. The skin oils are removed, and the skin becomes red, cracked and dry (Section 9). The effect of carbon tetrachloride on the eyes either as a vapor or as a liquid, is one of irr with lacrimation and burning.

Industrial poisoning is usually acute, with malaise, headache, nausea, dizziness, and confusion, which may be followed by stupor and sometimes loss of consciousness. Symptoms of liver and kidney damage may follow later, with development of dark urine, sometimes jaundice and liver enlargement, followed by scanty urine, albumenuria and renal casts, uremia may develop and cause death. Where the exposure has been less acute, the picture is usually one of headache, dizziness, nausea, vomiting epigastric distress, loss of appetite, and fatigue. Visual disturbances (blind spots, spots before the eyes, a visual "haze" and restriction of the visual fields), secondary anemia, and occasionally a slight jaundice may occur. Dermatitis may be noticed on the exposed parts. It is an exper (+) carc and teratogen and an exper neo. [3, 9, 23] Caution: Severe reaction with allyl alcohol, Al, Al(C₂H₅)₃, Ba, (benzoyl peroxide + C₂H₄), Be, BrF₃, Ca(OCl)₂, diborane, C₂H₄, dimethyl formamide, disilane, F₂, Li, Mg, liquid O₂, Pu, K, (AgClO₄ + HCl), potassium-*tert*-butoxide, Na, NaK, tetrasilane, trisilane, U, Zr, burning wax. [19] See chlorinated HC. It has been banned from household use by FDA.

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic fumes of phosgene.

CARBON TETRAFLUORIDE. Syn: *tetrafluoromethane*. Colorless gas. CF₄, mw: 88.01, mp: -184°, bp: -127.7°, d: 1.96 @ -184°.

THR = LOW via inhal route. Appears to be less chronically toxic than carbon tetrachloride. See halogenated HC. Violent reaction with Al. [19]

Disaster Hazard: See halogenated HC, aliphatic.

CARBON TETRAIODIDE. Syn: *tetraiodomethane*. Octahedral, red crystals. CI₄, mw: 519.69, mp: 171° decomp, d: 4.32.

THR = U. See also iodoform. Vigorous reaction with BrF₃. [19]

CARBON TRICHLORIDE. See hexachloroethane.

BROMINE. Rhombic crystals or dark red liquid. Br_2 , mw: 159.83, fp: -7.3° , bp: 58.73° , d: 2.928 @ 59° , 3.12 @ 20° , vap. press: 175 mm @ 21° , 1 atm @ 58.2° , vap. d: 5.5.

Acute tox data: Oral LD_{50} (human) = 14 mg/kg; inhal LC_{50} (human) = 1000 ppm; inhal LC_{50} (rabbit) = 180 ppm for 7 hrs. [3]

THR = HIGH via oral and inhal routes. The action of bromine is essentially the same as that of chlorine, being an irritant to the membranes of the eyes and upper respiratory tract. Severe exposures may result in pulmonary edema. Usually, however, the irritant qualities of the chemical force the workman to leave the exposure before serious poisoning can result. Chronic exposure is similar to therapeutic ingestion of excessive bromides. See also bromides. Regular physical examinations should be made upon people who work with bromine or bromides.

Radiation Hazard: For permissible levels see Table 5A.5.

Fire Hazard: Mod, in the form of liquid or vapor by spontaneous chemical reaction with reducing materials. May react violently with acetaldehyde, C_2H_2 , acrylonitrile, Al, NH_3 , Sb, B, Ca_3N_2 , Cs_2O , Cs_2C_2 , CsC_2H , ClF_3 , C_2 , CuH_2 , Cu_2C_2 , dimethyl formamide, ethyl phosphine, F_2 , Ge, H_2 , Fe_2C , isobutyrophenone, Li, Li_2C_2 , Li_2Si_2 , Mg_3P_2 , CH_3OH , $\text{Ni}(\text{CO})_4$, NI_3 , olefins, OF_2 , O_3 , PH_3 , P, PO_x , K, Rb_2C_2 , RbC_2H , AgN_3 , Na, Na_2C_2 , NaC_2H , Sr_3P , Sn, UC_2 , ZrC_2 . [19] A very powerful oxidizer.

Disaster Hazard: Highly dangerous; when heated, emits highly toxic fumes; will react with water or steam to produce toxic and corrosive fumes; can react vigorously with reducing materials.

BROMINE ANALOG OF DDT. See 1-trichloro-2,2-bis(p-bromophenyl)ethane.

BROMINE AZIDE. Syn: *bromoazide*. Crystals or red liquid. BrN_3 , mw: 121.94, mp: 45° , bp: explodes.

THR = HIGH. See bromine and azides.

Fire Hazard: Mod, in the form of vapor by chemical reaction. A powerful oxidant. See also bromine. Can explode spontaneously. Reacts vigorously with Sb, As, ethyl ether, P, Ag, Na. [19]

Explosion Hazard: Mod, when exposed to heat.

Disaster Hazard: Dangerous; when heated to decompose, emits highly toxic fumes of bromine and explodes; will react with water or steam to produce toxic and corrosive fumes; can react on contact with reducing materials.

BROMINE CHLORIDE. Reddish-yellow liquid or gas.

BrCl , mw: 115.37, bp: decompose @ 10° .

THR = See bromine, chlorine.

Fire Hazard: Mod, in the form of vapor by spontaneous

chemical reaction. A powerful oxidant. See also bromine.

Disaster Hazard: Dangerous; when heated to decompose, emits highly toxic fumes of bromine and chlorine; will react with water or steam to produce toxic and corrosive fumes; on contact with reducing material, it can react vigorously.

BROMINE CYANIDE. See cyanogen bromide.

BROMINE DIOXIDE. Light yellow crystals. BrO_2 , mw: 111.92, mp: 0° (decompose).

THR = See bromine.

Fire Hazard: Mod, in the form of vapor by chemical reaction with reducing agents. A strong oxidant.

Disaster Hazard: Dangerous; when heated to decompose, emits highly toxic fumes of bromine; will react with water or steam to produce toxic and corrosive fumes; can react vigorously with reducing materials.

BROMINE HYDRATE. Red crystals. $\text{Br}_2 \cdot 10\text{H}_2\text{O}$, mw: 340.0, mp: 6.8° (decompose).

THR = See bromine.

Fire Hazard: Mod, in the form of vapor by chemical reaction with reducing materials. A strong oxidant.

Disaster Hazard: Dangerous; see bromine, on contact with water or steam, will react to produce toxic and corrosive fumes; can react vigorously with reducing materials.

BROMINE MONOFLUORIDE. BrF , mw: 98.9.

THR = HIGH. Powerful irritant. See bromine, fluorine.

Reacts violently with organic matter, water. [19]

BROMINE MONOXIDE. Dark brown crystals. Br_2O , mw: 175.83, mp: -18° (decompose).

THR = See bromine.

Fire Hazard: Mod, by chemical reaction with reducing agents. A strong oxidant.

Disaster Hazard: Dangerous; see bromine; will react with water or steam to produce toxic and corrosive fumes; can react vigorously with reducing materials.

BROMINE OCTOXIDE. White crystals. Br_8O_8 , mw: 367.75, mp: stable @ -40° .

THR = See bromine.

Fire Hazard: Mod, upon contact with reducing agents. A strong oxidant.

Disaster Hazard: Dangerous; see bromine; will react with water or steam to produce toxic and corrosive fumes; can react vigorously with reducing materials.

BROMINE PENTA FLUORIDE. Colorless fuming liquid. BrF_5 , mw: 174.92, mp: -61.3° , bp: 40.5° , d: 2.466 @ 25° , vap. d: 6.05.

THR = HIGH and corrosive. See bromine and fluorides. Reacts violently with acetic acid, NH_3 , As, C_6H_6 , H_2S , cellulose, charcoal, $\text{C}_2\text{H}_5\text{OH}$, I, alkaline

TRICHLOROETHYLENE. Syn: *ethinyl trichloride*, *ethylene trichloride*. Stable, colorless, heavy, mobile liquid, chloroform-like odor. $\text{CHCl}_2\text{CCl}_2$, mw: 131.40, mp: -73° , bp: 87.1° , fp: -86.8° , d: 1.45560 @ $25^\circ/4^\circ$, autoign. temp.: 788°F ; vap. press: 100 mm @ 32° , vap. d: 4.53, flash p: none, lel = 12.5%, uel = 90%.

Acute tox data: Oral LD_{50} (human) = 857 mg/kg; 160 ppm for 83 min \rightarrow human CNS effects; 110 ppm for 8 hrs \rightarrow inhal human irr effects; oral LD_{50} (rat) = 4920 mg/kg; inhal LC_{50} (rat) = 8000 ppm for 4 hrs; ip LD_{50} (dog) = 1900 mg/kg; iv LD_{50} (dog) = 150 mg/kg. [3]

THR = HIGH via iv; MOD via ip, inhal, oral routes. An exper (S) carc. [3, 13] Inhal of high conc causes narcosis and anesthesia. A form of addiction has been observed in exposed workers. Prolonged inhal of mod conc causes headache and drowsiness. Fatalities following severe, acute exposure have been attributed to ventricular fibrillation resulting in cardiac failure. There is damage to liver and other organs from chronic exposure. Cases have been reported but are of questionable validity. Determination of the metabolites trichloroacetic acid and trichloroethanol in urine reflects the absorption of trichloroethylene. A food additive permitted in food for human consumption. [109] A common air contaminant.

Fire Hazard: Low, when exposed to heat or flame. High conc of trichloroethylene vapor in high-temp. air can be made to burn mildly if plied with a strong flame. Though such a condition is difficult to produce, flames or arcs should not be used in closed equipment which contains any solvent residue or vapor. Can react violently with Al, Ba, N_2O_4 , Li, Mg, liquid O_2 , O_2 , KOH, KNO_3 , Na, NaOH, Ti. [19]

Boiling Point Heating: No.

Disaster Hazard: Dangerous; see chlorides.

TRICHLOROETHYL SILANE. $\text{C}_2\text{H}_5\text{SiCl}_3$, mw: 163.5.

THR = Reacts violently with water. [19]

TRICHLOROFLUOROGERMANE. Colorless liquid. GeCl_3F , mw: 197.97, mp: -49° , bp: 37.5° .

THR = See fluorides, germanium compounds and chlorides.

1-TRICHLOROFLUOROETHANE. $\text{C}_2\text{H}_2\text{Cl}_3\text{F}$, mw: 151.4.

HR = No data. See fluorides. Violent reaction with Ba. [19]

TRICHLOROFLUOROMETHANE. See fluorotrichloromethane.

TRICHLOROGERMANE. Syn: *germanium chloroform*. Colorless liquid. GeHCl_3 , mw: 179.98, mp: -71.0° , bp: 75.2° , d: 1.93 @ 0°C .

THR = See hydrochloric acid and germanium compounds.

TRICHLOROISOCYANURIC ACID. White crystals, chlorine odor, mod sol in water. $(\text{CINCO})_3$, mw: 232.5, mp: 225° – 230° (decomp).

Acute tox data: Oral LD_{50} (rat) = 700–800 mg/kg.

THR = MOD-HIGH via oral route. Toxicity symptoms include emaciation, lethargy, weakness and delayed death. Autopsy shows inflammation of GI tract, liver discoloration and kidney hyperemia. A powerful oxidizer.

Disaster Hazard: Dangerous; when heated to decomp, emits chloride and carbon monoxide fumes.

1,1,1-TRICHLOROISOPROPYL ALCOHOL. Syn: *isopral*, *1,1,1-trichloro-2-propanol*. Crystals, camphor-like odor, pungent taste, water-sol. $\text{C}_3\text{H}_5\text{Cl}_3\text{O}$, mw: 163.4, mp: 50° , bp: 162° .

Acute tox data: Oral LD_{50} (rat) = 1000 mg/kg. [3]

THR = MOD via oral route. See also chlorinated hydrocarbons, aliphatic.

Disaster Hazard: Dangerous; see chlorides.

TRICHLOROMELAMINE. Syn: *TCM*. White powder, slightly water-sol. $\text{C}_3\text{H}_3\text{Cl}_3\text{N}_6$, mw: 229.4, autoign. temp.: 320°F .

Acute tox data: Oral LD_{50} (mice) = 490 mg/kg. [3]

THR = HIGH via oral route.

Fire Hazard: Mod, in the pure state, when heated or ignited by spark or flame; reacts vigorously to evolve smoke and heat; reacts with acetone, NH_3 , aniline, diphenylamine, turpentine. [19] Vendor can supply directions for handling.

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic chloride and NO_x fumes.

TRICHLOROMETHANE. See chloroform.

TRICHLOROMETHANE SULFENYL CHLORIDE. See perchloromethyl mercaptan.

TRICHLOROMETHYL CHLOROFORMATE. See diphosgene.

TRICHLOROMETHYL ETHER. A liquid of pungent odor. $\text{CHCl}_2\text{OCH}_2\text{Cl}$, mw: 149.42, bp: 130° – 132° , d: 1.5066 @ 10° .

THR = HIGH irr to skin, eyes and mu mem and via oral, inhal routes. See also ethers.

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic fumes; will react with water or steam to produce toxic and corrosive fumes.

TRICHLOROMETHYL PERCHLORATE. Cl_3CClO_4 , mw: 217.8.

THR = Detonates @ 40° .

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic fumes.

HYDRASTININE. White-yellowish needles.

$C_{11}H_{13}NO_3$, mw: 207.2, mp: 116°–117°.

THR = HIGH via oral route. Can cause paralysis of vasomotor nerves and vagus endings.

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic fumes.

HYDRATED ALUMINA. See aluminum hydroxide.

HYDRATED ALUMINUM HYDROXIDE. See aluminum hydroxide.

HYDRATED ALUMINUM SILICATE. See kaolin.

HYDRATED LEAD OXIDE. See lead hydroxide.

HYDRATED LIME. See calcium hydroxide.

HYDRAZIDE-*o*-ANISIC ACID. $C_8H_{10}N_2O_2$, mw: 166.2.

THR = An exper carc. [3]

HYDRAZIDE-*p*-ANISIC ACID.

THR = An exper carc. [3]

HYDRAZINE. Syns: *hydrazine base*, *diamine*, *hydrazine anhydrous*. Colorless, fuming liquid, white crystals. NH_2NH_2 , mw: 32.05, mp: 1.4°, bp: 113.5°, flash p: 100°F (OC), d: 1.1011 @ 15° (liq), autoign. temp.: can vary from 74°F in contact with iron rust to 270°F in contact with black iron to 313°F in contact with stainless steel to 518°F in contact with glass, vap. d: 1.1; lel = 4.7%, uel = 100%.

Acute tox data: Oral LD_{50} (rat) = 60 mg/kg; inhal LC_{50} (rat) = 570 ppm for 4 hrs; dermal LD_{50} (rabbit) = 91 mg/kg; iv (rabbit) = 20 mg/kg. [3]

THR = HIGH via oral, iv and dermal routes. May cause skin sensitization as well as systemic poisoning. Hydrazine and some of its derivatives may cause damage to the liver and destruction of red blood cells. See phenyl hydrazine. An exper (+) carc. [3, 10, 14] of lung, nervous system, liver, kidney, hematopoietic organs, breast, subcutaneous tissue.

Fire Hazard: Dangerous, when exposed to heat, flame or oxidizing agents; a powerful reducing agent.

Explosion Hazard: Severe, when exposed to heat or flame or by chemical reaction with alkali metals, NH_3 , Cl_2 , chromates, CuO , Cu ++ salts, F_2 , H_2O_2 , iron rust, metallic oxides, Ni , $Ni(ClO_4)_2$, HNO_3 , N_2O , O_2 , liquid O_2 , $K_2Cr_2O_7$, $Na_2Cr_2O_7$, tetryl, zinc diamide, $Zn(C_2H_5)_2$. Can self-ignite when absorbed on earth, asbestos, cloth, wood. [19] It is a powerful explosive, much used in rocket fuels. It is very sensitive and must not be used without full and complete instructions from the manufacturer as to handling, storage and disposal.

Disaster Hazard: Dangerous; when heated to decomp,

emits highly toxic fumes of nitrogen compounds; may explode by heat or chemical reaction.

To Fight Fire: Foam, CO_2 , dry chemical.

HYDRAZINE AZIDE. $H_2NNH_3N_3$, mw: 75.1, mp: 75.4.

THR = An explosive salt; even when moist. A hot wire decomp it violently. [19]

HYDRAZINE BASE. See hydrazine.

HYDRAZINE DIBORANE. White crystalline powder, hygroscopic. $B_2N_2H_{10}$, mw: 59.7, d: 0.91.

THR = See boron hydrides, boron compounds, hydrazine.

HYDRAZINE CHLORITE. $H_2NNH_3ClO_2$, mw: 100.5.

THR = A very flam, explosive salt. [19]

HYDRAZINE HYDRATE. H_6ON_2 , mw: 50.1, mp: -40°, bp: 118.5° @ 740 mm. Colorless, fuming liquid.

THR = HIGH via oral route. An exper carc. [3]
Violent reaction with HgO , Na , $SnCl_2$, 2,4-dinitrochlorobenzene. [19]

HYDRAZINE NITRATE. $H_2NNH_3NO_3$, mw: 95.1.

THR = Violent reactions with Cu , metal carbides, metal nitrides, metal oxides, metal sulfides, Zn . [19]
See hydrazine.

HYDRAZINE PERCHLORATE. Solid, decomp in water, sol in alcohol, insol in ether, benzene, chloroform and carbon disulfide. $N_2H_4 \cdot HClO_4 \cdot \frac{1}{2}H_2O$, mw: 141.5, d: 1.939, mp: 137°, bp: 145° decomp.

THR = HIGH. See hydrazine, perchlorates.

Disaster Hazard: An explosive; can be detonated by shock or friction. [19]

HYDRAZINE SELENATE. $N_2H_4 \cdot H_2SeO_4$, mw: 177.

THR = An explosive salt. [19] HIGH irr to skin, eyes and mu mem. HIGH via oral and inhal routes also.
See selenium compounds and hydrazine.

HYDRAZINE SULFATE. Colorless crystals, water-sol, insol in alcohol. $2N_2H_4 \cdot H_2SO_4$, mw: 162.2, mp: 85°.

THR = MOD to HIGH acute oral. An exper carc. [3]
See hydrazine.

HYDRAZINE TARTRATE. Syn: *hydrazine acid tartrate*. Crystals, water-sol. $H_2NNH_2 \cdot C_4H_6O_6$, mw: 182.1, mp: 183°.

THR = HIGH. See hydrazine.

2-HYDRAZINO ETHANOL. See 2-hydroxyethyl hydrazine.

2-HYDRAZINO-4-(5-NITRO-2-FURYL)THIAZOLI
 $C_7H_6O_3N_4S$, mw: 226.2.

THR = An exper carc and neo. [3, 23]

2-HYDRAZINO-4-(*p*-NITROPHENYL)THIAZOLI
 $C_9H_8O_2N_4S$, mw: 236.3.

THR = An exper carc and neo. [3, 23]

acute fire hazards and easily oxidized materials. Ammonium nitrate must not be confined, because if a fire should start, confinement can cause detonation with extremely violent results. Also reacts violently with Al, BP, cyanides, esters, PN_2H , P, NaCN, SnCl_2 , sodium hypophosphite, thiocyanates. [19]

Disaster Hazard: Dangerous, due to fire and explosion hazard. On decomp, they emit toxic fumes. They are powerful oxidizing agents which may cause violent reaction with reducing materials. Nitrates should be protected carefully, as discussed in detail in Section 7.

NITRATINE. See sodium nitrate.

NITRATING (MIXED) ACID. See nitric acid and sulfuric acid.

NITRE. See potassium nitrate.

NITRIC ACID. Syn: *aqua fortis*, *hydrogen nitrate*, *azotic acid*. Transparent colorless or yellowish, fuming, suffocating, caustic and corrosive liquid. HNO_3 , mw: 63.02, mp: -42° , bp: 86° , d: 1.502.

THR = VERY HIGH irr to skin, eyes and mu mem.

Can affect the teeth. It destroys tissue, causes burns, stains skin, destroys eyes. Causes upper respiratory irr which may seem to clear up only to return in a few hours and more severely. [88] The exact composition of the "fumes" or vapor produced by nitric acid depends upon such factors as temp., humidity and whether or not the acid comes in contact with other materials, such as heavy metals or organic compounds. Depending upon these factors, the vapor will consist of a mixture of the various oxides of nitrogen and of nitric acid vapor. Nitric acid vapor is high irr to the mu mem of the eyes and respiratory tract and to the skin. It is corrosive to the teeth. Because of its irr properties, chronic exposure to dangerous conc of the acid vapor seldom occur.

Fire Hazard: Mod, by chemical reaction with reducing agents. It is a powerful oxidizing agent.

Explosion Hazard: Reacts violently with acetic acid, acetic anhydride, (acetone + acetic acid), (acetone + H_2SO_4), acetylene, acrolein, acrylonitrile, allyl alcohol, allyl chloride, 2-amino ethanol, NH_3 , NH_4OH , aniline, anion exchange resins, (dichromate + anion exchange resins), Sb, AsH_3 , Bi, B, boron decahydride, BP, BrF_3 , *n*-butyraldehyde, Ca hypophosphite, C, Cs_2C_2 , 4-chloro-2-nitroaniline, ClF_3 , chlorosulfonic acid, cresol, cumene, Cu_3N_2 , CuN_3 , cyanides, cyclic ketones, cyclohexanol, cyclohexanone, diborane, 2,6-di-*tert*-butyl phenol, diisopropyl ether, epichlorohydrin, ethanol, *m*-ethyl-aniline, ethylene diamine, ethylene imine, 5-ethyl-2-methyl pyridine, 5-ethyl-2-picoline, $\text{C}_2\text{H}_5\text{PH}_2$, FeO,

F_2 , furfuryl alcohol, Ge, glyoxal, hydrazine, HN_3 , HI, H_2O_2 , H_2Se , H_2S , H_2Te , (indane + H_2SO_4), isoprene, (ketones + H_2O_2), (lactic acid + HF), Li, Li_6Si_2 , Mg, Mg_3P_2 , Mg-Ti alloy, Mn, mesitylene, mesityl oxide, 2-methyl-5-ethyl pyridine, 4-methyl-cyclohexanone, NdP, nitrobenzene, oleum, organic matter, PH_3 , PH_4I , P, P_4I_3 , PCl_3 , phthalic acid, phthalic anhydride, KH_2PO_2 , β -propiolactone, propylene oxide, pyridine, Rb_2C_2 , Se, selenium iodo-phosphide, (Ag + ethanol), Na, NaN_3 , NaOH, SbH_3 , sulfamic acid, (H_2SO_4 + glycerides), terpenes, B_4H_{10} , thiocyanates, thiophene, Ti, Ti alloy, Ti-Mg alloy, (H_2SO_4 + $\text{C}_6\text{H}_5\text{CH}_3$), toluidine, triazine, uns-dimethyl hydrazine, U, U-Nd alloy, U-Nd-Zr alloy, vinylacetate, vinylidene chloride, Zn, Zr-U alloys. [19]

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic fumes of NO_x and hydrogen nitrate; will react with water or steam to produce heat and toxic and corrosive fumes.

To Fight Fire: Water.

NITRIC ACID, ANHYDROUS.

See nitric acid, fuming.

NITRIC ACID, FUMING RED. Syn: *nitric acid, anhydrous*. Colorless to yellow to red corrosive liquid. $\text{NHO}_3 + \text{N}_2\text{O}_5$, d: > 1.480 .

Acute tox data: Inhal LC_{50} (rat) = 65 ppm of NO_2 for 4 hrs. [3]

THR = VERY HIGH irr to skin, eyes and mu mem. A corrosive poison.

Fire Hazard: Dangerous; very powerful oxidizing agent.

Explosion Hazard: Mod; can react explosively with many reducing agents.

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic fumes of NO_x ; will react with water or steam to produce heat and toxic, corrosive and flam vapors.

NITRIC ACID, FUMING WHITE.

Acute tox data: Inhal LC_{50} (rat) = 244 ppm of NO_2 for 30 min. [3]

THR = VERY HIGH irr to skin, eyes and mu mem. A corrosive poison.

NITRIC ANHYDRIDE. See nitrogen pentoxide.

NITRIC ETHER. See ethyl nitrate.

NITRIC OXIDE. Syn: NO_x . Colorless gas, blue liquid and solid. NO, mw: 30.01, mp: -161° , bp: -151.18 , d: 1.3402 g/liter, liquid: 1.269 @ -150° .

Acute tox data: Inhal LD_{50} (mouse) = 320 ppm; inhal LC_{50} (rabbit) = 315 ppm for $\frac{1}{4}$ hr. [3]

THR = HIGH irr via inhal route and to skin, eyes and mu mem. A poison gas. Exposure to such fumes

ppm for $\frac{1}{2}$ hr; inhal LC_{50} (guinea pig) = 5000 ppm for 5 min. [3]

THR = HIGH irr via inhal route and to skin, eyes and mu mem.

This gas is dangerous to the eyes, as it causes irr and inflammation of the conjunctiva. It has a suffocating odor and is a corrosive and poisonous material. In moist air or fogs, it combines with water to form sulfurous acid, but is only very slowly oxidized to sulfuric acid. Conc of 6–12 ppm cause immediate irr of the nose and throat, while 0.3–1 ppm can be detected by the average individual possibly by taste rather than by sense of smell. 3 ppm has an easily noticeable odor and 20 ppm is the least amount which is irr to the eyes. 10,000 ppm is an irr to moist areas of the skin within a few minutes of exposure.

It chiefly affects the upper respiratory tract and the bronchi. It may cause edema of the lungs or glottis, and can produce respiratory paralysis. Conc of <1 ppm are believed to be injurious to plant foliage.

This material is so irr that it provides its own warning of toxic conc. 400–500 ppm is immediately dangerous to life and 50–100 ppm is considered to be the maximum permissible conc for exposures of 30–60 min. Excessive exposures to high enough conc of this material can be fatal. Its toxicity is comparable to that of hydrogen chloride. However, less than fatal conc can be borne for fair periods of time with no apparent permanent damage. It is used as a fumigant, insecticide and fungicide, and a chemical preservative food additive. [109] It is a common air contaminant. It reacts violently with acrolein, Al, $CsHC_2$, CsO , chlorates, ClF_3 , Cr, FeO , F_2 , Mn, KHC_2 , $KClO_3$, Rb_2C_2 , Na, Na_2C_2 , SnO , lithium acetylene carbide diammino. [19]

Disaster Hazard: Dangerous; will react with water or steam to produce toxic and corrosive fumes.

Treatment and Antidotes: Personnel who have shown toxicity symptoms when exposed to this material should immediately be removed to fresh air. If the eyes are involved they should be irrigated with copious quantities of warm water. If the symptoms persist, call a physician.

SULFURETTED HYDROGEN. See hydrogen sulfide.

SULFUR FLOUR. See sulfur.

SULFUR FLUORIDE. Syn: *sulfur monofluoride*. Colorless gas. S_2F_2 , mw: 102.12, mp: -104.5° , bp: -99° , d(liquid): 1.5 @ -100° .

THR = See fluorides and hydrofluoric acid.

SULFUR HEPTOXIDE. Syn: *persulfur heptoxide*.

Viscous liquid or possibly needle-like crystals. S_2O_7 , mw: 176.1, mp: 0° , bp: sublimates @ 10° .

THR = HIGH irr via oral and inhal to skin, eyes and mu mem.

Fire Hazard: Mod, when exposed to heat or flame or by chemical reaction. When heated, or in contact with water or alcohol, it liberates oxygen.

Disaster Hazard: Dangerous; when heated to decompose emits highly toxic fumes of SO_2 ; can react with reducing materials.

To Fight Fire: CO_2 , dry chemical.

SULFUR HEXAFLUORIDE. Colorless gas. SF_6 , mw: 146.06, mp: -51° (sublimates @ -64°), vap. d: 6.607 d(liquid): 1.67 @ -100° .

THR = This material is chemically inert in the pure state and is considered to be physiologically inert as well. However, as it is ordinarily obtainable, it can contain variable quantities of the low sulfur fluorides. Some of these are toxic, very reactive chemically and corrosive in nature. These material can hydrolyze on contact with water to yield hydrogen fluoride, which is highly toxic and very corrosive. In high conc and when pure it may act as a simple asphyxiant. Vigorous reaction with disilane [19] May explode.

Disaster Hazard: Dangerous; when heated to decompose emits highly toxic fumes of fluorides and SO_2 .

SULFURIC ACID. Syn: *oil of vitriol, dipping acid*. Colorless, oily liquid. H_2SO_4 , mw: 98.08, mp: 10.49° , bp: 330° , d: 1.834, vap. press 1 mm @ 145.8° .

Acute tox data: Oral LD_{50} (rat) = 2140 mg/kg. [3]

THR = MOD via oral route. Extremely irr, corrosive and toxic to tissue. Contact with the body results in rapid destruction of tissue, causing severe burns. No systemic effects due to continual ingestion of small amounts of this material have been noted. There are systemic effects secondary to tissue damage caused by contact with it. However, repeated contact with dilute solutions can cause a dermatitis, and repeated or prolonged inhal of a mist of sulfuric acid can cause an inflammation of the upper respiratory tract leading to chronic bronchitis. Sensitivity to sulfuric acid or mists or vapors varies with individuals. Normally 0.125–0.50 ppm may be mildly annoying and 1.5–2.5 ppm can be definitely unpleasant. 10–20 ppm is unbearable.

Workers exposed to low conc of the vapor gradually lose their sensitivity to its irr action. Inhal of conc vapor or mists from hot acid or oleum can cause rapid loss of consciousness with serious damage to lung tissue. In conc form it acts as a powerful caustic to the skin destroying the epidermis and penetrating some distance into the skin and sub-

cutaneous tissues, in which it causes necrosis. This causes great pain, and, if much of the skin is involved, it is accompanied by shock, collapse and symptoms similar to those seen in severe burns. The fumes or mists of this material cause coughing and irr of the mu mem of the eyes and upper respiratory tract. Severe exposure may cause a chemical pneumonitis; erosion of the teeth due to exposure to strong acid fumes has been recog in industry. It is used as a general purpose food additive; it migrates to food from packaging materials. [109] A common air contaminant.

Fire Hazard: This is a very powerful, acidic oxidizer which can ignite or even explode on contact with many materials; i.e., acetic acid, acetone cyanhydrin, (acetone + HNO_3), (acetone + $\text{K}_2\text{Cr}_2\text{O}_7$), acetonitrile, acrolein, acrylonitrile, (acrylonitrile + H_2O), (alcohols + H_2O_2), allyl alcohol, allyl chloride, NH_4OH , 2-amino ethanol, NH_4 triperchromate, aniline, (bromates + metals), BrF_3 , *n*-butyraldehyde, carbides, CoHC_2 , chlorates, (metals + chlorates), ClF_3 , chlorosulfonic acid, Cu_3N , diisobutylene, (dimethyl benzylcarbinol + H_2O_2), epichlorohydrin, ethylene cyanhydrin, ethylene diamine, ethylene glycol, ethylene imine, fulminates, HCl , H_2 , IF_7 , (indene + HNO_3), Fe , isoprene, Li_6Si_2 , Hg_3N_2 , mesityl oxide, metals, (HNO_3 + glycerides), *p*-nitrotoluene, perchlorates, HClO_4 , (C_6H_6 + permanganates), pentasilver trihydroxydiamino phosphate, (1-phenyl-2-methyl propyl alcohol + H_2O_2), P , $\text{P}(\text{OCN})_3$, picrates, potassium-*tert*-butoxide, KClO_3 , KMnO_4 , (KMnO_4 + KCl), (KMnO_4 + H_2O), β -propiolactone, RbHC_2 , propylene oxide, pyridine, Na , Na_2CO_3 , NaOH , steel, styrene monomer, water, vinyl acetate, (HNO_3 + toluene). [19]

Disaster Hazard: Dangerous; when heated, emits highly toxic fumes; will react with water or steam to produce heat; can react with oxidizing or reducing materials.

Treatment and Antidotes: Speed in removing this material from contact with the body is of primary importance. Start first aid at once. In all cases of contact in any form, delay can result in serious injuries and all persons injured should be referred to a physician. However, immediately give prolonged applications of running water to wash the material off the body. Remove contaminated clothing. Subject patient to a deluge type of shower if this is available. Do not attempt to neutralize the acid in contact with the skin until all areas of contact have been thoroughly irrigated with running water. Then applications of mild alkaline solutions may be in order. Shock symptoms will often be noted in

cases of severe or extensive burns. In such a case, put patient on his back, keep him warm but not hot until physician arrives. Do not apply oils or ointments to burned area without instructions from a physician. If eyes are involved, they should immediately be irrigated with copious quantities of warm water for at least 15 min.

If the material has been taken internally, it causes burns of the mu mem of the throat, esophagus, and stomach. Do not attempt to induce vomiting in patients who have swallowed strong solutions of sulfuric acid. Do not give anything by mouth to an unconscious patient. If he is conscious, encourage him to wash out his mouth with copious amounts of water, then have him drink milk mixed with whites of eggs. If this is not available, have him drink as much water as possible. Get medical help.

SULFURIC ACID, AROMATIC. Syn: *elixir of vitriol*. Clear, reddish-brown liquid, peculiar aromatic odor, pleasant acid taste when diluted.

THR = Corrosive. See sulfuric acid.

Fire Hazard: Mod, when exposed to heat or flame. See also ethyl alcohol and sulfuric acid.

Explosion Hazard: Mod, in the form of vapor (ethyl alcohol) when exposed to flame.

Disaster Hazard: Dangerous; see sulfuric acid and ethyl alcohol.

SURFURIC ACID, FUMING. See oleum.

SULFURIC ACID MIST. An airborne suspension of sulfuric acid in the form of droplets.

Acute tox data: Inhal TC_{LO} (human) = $3 \text{ mg/m}^3 \rightarrow$ irr of the mouth, skin and eyes. Inhal TC_{LO} (human) = 0.35 mg/m^3 for 3 min \rightarrow pulmonary irr effects; inhal LC_{LO} (rat) = 178 ppm for 7 hrs; inhal LC_{LO} (mice) = 140 ppm for $3\frac{1}{2}$ hrs. [3]

THR = HIGH irr to skin, eyes and mu mem.

SULFURIC ACID SLUDGE. See selenium compounds.

SULFURIC CHLORIDE. See sulfuryl chloride.

SULFURIC CHLOROHYDRIN. See chlorsulfonic acid.

SULFURIC ETHER. See ethyl ether.

SULFURIC OXYCHLORIDE. See sulfuryl chloride.

SULFURIC OXYFLUORIDE. See sulfuryl fluoride.

SULFUR MONOBROMIDE. See sulfur bromide.

SULFUR MONOCHLORIDE. See sulfur chloride.

SULFUR MONOFLUORIDE. See sulfur fluoride.

SULFUR MONOOXYTETRACHLORIDE. Dark red liquid. S_2OCl_4 , mw: 221.96, bp: $60^\circ\text{--}61^\circ$, d: 1.656 @ 0° .

FERRIC OXALATE. Yellow powder.

$\text{Fe}_2(\text{C}_2\text{O}_4)_2 \cdot 5\text{H}_2\text{O}$, mw: 465.8, mp: decomp @ 100° .

THR = HIGH via oral and inhal routes. A MILD irr to skin, eyes and mu mem.

Fire Hazard: Slight.

FERRIC OXIDE. Syn: *iron oxide pigment*. Fe_2O_3 , mw: 159.70.

THR = Reacts violently with Al, $\text{Ca}(\text{OCl})_2$, Cs_2C_2 , N_2H_4 , ethylene oxide. [19] An exper (\pm) carc. [3, 9]

FERRIC PHOSPHATE. Syn: *iron phosphate*. Yellowish to white powder, insol in water, sol in acids. $\text{FePO}_4 \cdot 2\text{H}_2\text{O}$, mw: 187, d: 2.87.

THR = No data. A nutrient and/or dietary supplement food additive. Also used as a trace mineral added to animal feeds. [109]

FERRIC PYROPHOSPHATE. Syn: *iron pyrophosphate*. Yellowish-white powder, insol in water, sol in dilute acids. $\text{Fe}_2(\text{P}_2\text{O}_7)_3$, mw: 745.3.

THR = No data. A nutrient and/or dietary supplement food additive. Also used as a trace mineral added to animal feeds. [109]

FERRIC SODIUM PYROPHOSPHATE.

THR = No data. Used as a nutrient and/or dietary supplement food additive. [109]

FERRIC SULFATE. Rhombic gray crystals, slightly water-sol, hygroscopic. $\text{Fe}_2(\text{SO}_4)_3$, mw: 399.9, d: 3.097 @ 18° , mp: 480° (decomp).

THR = LOW via oral route. A MILD irr. May cause local irr. Practically non-toxic systemically. See iron compounds. It is a substance which migrates to food from packaging materials. [109]

FERRIC SULFIDE. Yellow-green crystals. Fe_2S_3 , mw: 207.90, mp: decomp, d: 4.3.

THR = Easily evolves H_2S , which is very toxic. See also hydrogen sulfide.

Fire Hazard: See sulfides.

Explosion Hazard: See sulfides.

Disaster Hazard: See sulfides.

FERRIC THIOCYANATE. Cubic, black-red deliquescent crystals. $\text{Fe}(\text{SCN})_3$, mw: 230.10, mp: decomp.

THR = Probably LOW via oral and inhal routes. A MILD irr.

Disaster Hazard: Dangerous; when heated to decomp or on contact with acid or acid fumes, emits highly toxic fumes of cyanides.

FERRIC-m-VANADATE. Syn: *iron m-vanadate*.

Grayish-brown powder. $\text{Fe}(\text{VO}_3)_3$, mw: 352.70.

THR = See vanadium compounds.

FERRICYANIC ACID. Green-brown, deliquescent needles. $\text{H}_3\text{Fe}(\text{CN})_6$, mw: 215.0, mp: decomp.

THR = No data. Probably LOW.

Disaster Hazard: Dangerous; when heated to decomp or on contact with acid fumes, emits highly toxic fumes of cyanides.

FERRICYANIDES.

THR = No data: Ferricyanides as such are of low toxicity since the CN is bound. It has been stated but not conclusively proven that HCN can be liberated in the stomach as a result of contact with gastric acidity.

Disaster Hazard: Dangerous; when heated to decomp or on contact with acid or acid fumes, they emit highly toxic fumes of cyanides.

FERRITIN.

THR = An exper neo. [3]

FERROCENE. Syn: *dicyclopentadienyl iron*. Orange crystals, camphor odor, insol in water, sol in alcohol and ether. $\text{C}_{10}\text{H}_{10}\text{Fe}$, mw: 186.0, mp: 174° , sublimes $>100^\circ$, volatile in steam.

Acute tox data: Oral LD_{50} (rat) = 1320 mg/kg; ip LD_{50} (rat) = 500 mg/kg; ip LD_{50} (mouse) = 335 mg/kg. [3]

THR = HIGH via ip and MOD via oral routes.

Fire Hazard: Mod. Reacts violently with NH_4ClO_4 . [19]

Disaster Hazard: Dangerous; when heated to decomp, emits toxic fumes.

FERROCERIUM. An alloy of iron and misch metal.**FERROCYNANIC ACID.** White needles turning blue in moist air. $\text{H}_4\text{Fe}(\text{CN})_6$, mw: 216.0, mp: decomp.

THR = No data. Probably LOW. See also iron.

Disaster Hazard: Dangerous; when heated to decomp or on contact with acid or acid fumes, emits highly toxic fumes of cyanides.

FERROCYNANIDES.

THR = Ferrocyanides as such are of a LOW order of toxicity. But highly toxic decomp products can form upon mixing them with hot conc acids. Acid, basic or neutral solutions of ferrocyanides liberate hydrocyanic acid upon strong irradiation.

Disaster Hazard: Dangerous; when heated to decomp or on contact with acid or acid fumes, they emit highly toxic fumes of cyanides.

FERROSILICON. Crystalline, metallic solid. Fe + Si, d: 5.4.

THR = U. This material is decomp by moisture, under which conditions impurities may liberate such poisonous gases as phosphine and arsine.

Fire Hazard: Mod, by chemical reaction with moisture.

Explosion Hazard: Mod, by chemical reaction.

Disaster Hazard: Dangerous; will react with water or steam to produce hydrogen and other flam vapors;

FLUOXY PREDNISOLONE. $C_{21}H_{27}O_5F$, mw: 394.5.

THR = An exper teratogen. [3]

"FLURAL." Dry, free-flowing powder. $AlF_3SO_4 \cdot xH_2O$ to $Al_2F_7SO_4 \cdot xH_2O$.

THR = HIGH. See fluorides.

FLUX, BLACK.

THR = Dangerous! A low explosive. For details, see explosives, low.

FLUX, WHITE. Composition: sodium nitrate and sodium nitrite.

THR = Variable. See also nitrites and nitrates.

Fire Hazard: Dangerous. This is a strong oxidizing agent.

Disaster Hazard: Keep away from heat and open flame; do not store near reducing agents or easily oxidized materials.

FMN. See riboflavin-5'-phosphate.

FOAM. See Section 7.

FOLACIN. See pteroylglutamic acid.

FOLIC ACID. See pteroylglutamic acid.

FOLIMAT. Colorless to slightly yellow oily liquid, water-sol. $C_5H_{12}O_4PSN$, mw: 213.1, d: 1.32.

Acute tox data: Oral LD_{50} (rat) = 50 mg/kg; dermal LD_{50} (rat) = 700 mg/kg. [3]

THR = HIGH via oral and MOD via dermal routes.

An insecticide. Toxic to bees.

Disaster Hazard: See phosphorous compounds and sulfur compounds.

FOLPET. See phaltan.

FOOD AND DRUG ADMINISTRATION. See Section 10A.

FOOD COLOR RED #102. $3Na \cdot C_{20}H_{14}N_2S_3$, mw: 607.5.

THR = An exper carc. [3]

FOOD, DRUG AND COSMETIC ACT. See Section 10A.

FOOTS OIL.

THR = A recog carc. [14] See paraffin and petroleum waxes.

FORENSIC TOXICOLOGY AFFECTED BY INDUSTRIAL TOXICOLOGY. See Section 9.

FORMAL. See methylal.

FORMALDEHYDE (COMMERCIAL SOLUTIONS). Syns: *methanal*, *methyl aldehyde*, *formalin*. $HCHO$. Clear, water white, very slightly acid, gas or liquid, pungent odor. Pure formaldehyde is not available commercially because of its tendency to polymerize. It is sold as aqueous solutions containing from 37% to 50% formaldehyde by weight and varying amounts of methanol. Some alcoholic solutions are

used industrially and the physical properties and hazards may be greatly influenced by the solvent. mw: 30.03, $l_e l = 7.0\%$, $u_e l = 73.0\%$, autoign. temp.: $806^\circ F$, d: 1.0, bp: $-3^\circ F$, flash p: (37% methanol-free): $185^\circ F$, flash p: (15% methanol-free): $122^\circ F$.

Acute tox data: Oral LD_{50} (rat) = 800 mg/kg; inhal LD_{50} (rat) = 250 ppm for 4 hrs; sc LD_{50} (rat) = 420 mg/kg; dermal LD_{50} (rabbit) = 270 mg/kg; oral LD_{50} (women) = 36 mg/kg. [3, 20]

THR = HIGH irr to skin, eyes, mu mem. If swallowed it causes violent vomiting and diarrhea which can lead to collapse. A fungicide. A common air contaminant. An exper carc of the lung. [3] Frequent or prolonged exposure can cause hypersensitivity leading to contact dermatitis, possibly of an eczematoid nature.

Fire Hazard: Very dangerous for gas, moderate for vapors. Will burn above flash point if exposed to flame, sparks, etc. Should formaldehyde be involved in a fire, irr gaseous formaldehyde may be evolved.

Spont Heating: No.

Explosion Hazard: When aqueous formaldehyde solutions are heated above their flash points, a potential explosion hazard exists. High formaldehyde conc of methanol content lowers flash point. Reacts with NO_2 @ about 180° ; the reaction becomes explosive. Also reacts violently with $(HClO_4 + \text{aniline})$ and performic acid. [19]

Disaster Hazard: Mod dangerous; because of irr vapor which may be in toxic conc locally if storage tank is ruptured.

To Fight Fire: Stop flow of gas for pure form; alcohol foam for 37% methanol-free form.

FORMALDEHYDE ACETAMIDE. See formicin.

FORMALDEHYDE CYANOHYDRIN. See glycolonitrile.

FORMALDEHYDE DIMETHYL ACETAL. See methylal.

FORMALDEHYDE GAS. Syns: *methanal*, *methyl aldehyde*. Colorless gas, pungent suffocating odor. Very sol in water. $HCHO$, mw: 30.3, d(air = 1.000): 1.067, d(water = 1.000): 0.815 @ $-20^\circ/4^\circ$, mp: -92° , bp: -19.5° , autoign. temp.: $572^\circ F$.

THR = See formaldehyde (commercial solutions).

FORMALIN. See formaldehyde.

Formalin was originally used as a European trade name for 35% formaldehyde solution. It is commonly employed as a synonym for commercial formaldehyde.

FORMAMIDE. Syn: *methanamide*. Colorless, hygroscopic and oily liquid. $HCONH_2$, mw: 45.04, fp: 2.6° , vap. press: 29.7 mm @ 129.4° , flash p: $310^\circ F$ (COC), bp: 210° decomp, d: 1.134 @ $20^\circ/40^\circ$; 1.1292 @ $25^\circ/4^\circ$.

resultant suppression of urine. Jaundice, which may be severe, is a common result of the hemolysis. Frequently there is edema of the lungs, which may be accompanied by cyanosis. Kidney damage is common in patients surviving acute effects of the gas. A recognized carc. [14]

Signs of poisoning usually develop within several hours of exposure. Headache, dizziness, nausea and vomiting, epigastric pain and weakness occur early, followed by tea-colored urine, or bloody urine in the more severe cases. Some time later, albumen, and casts may appear in the urine, or, in serious cases, there may be suppression of urine. Jaundice and tenderness over the liver may appear about the same time. Blood examination shows an anemia which may be marked. In fatal cases, the patient may develop delirium, followed by coma and death. During the acute stage of poisoning and for some weeks after, arsenic may be demonstrated in the urine. See also arsenic and arsenic compounds.

Fire Hazard: Moderate, when exposed to flame.

Explosion Hazard: MOD, when exposed to Cl_2 , HNO_3 , ($\text{K} + \text{NH}_3$) or open flame. [19]

Disaster Hazard: Dangerous, extremely toxic. More toxic than its oxidation product; when heated to decomp, emits highly toxic fumes; can react vigorously with oxidizing materials.

ARSONOACETIC ACID. See aricyl acid.

ARSPHENAMINE. Syn: *3-diamino-4-dihydroxy-1-arsenobenzene hydrochloride*, Ehrlich 606, *salvarsan*. Light yellow hygroscopic powder. $\text{C}_{12}\text{H}_{12}\text{As}_2\text{N}_2\text{O}_2 \cdot 2\text{HCl} \cdot 2\text{H}_2\text{O}$, mw: 475.0.

Acute tox data: iv LD_{50} (rat) = 100 mg/kg. [3]

THR = HIGH via iv route. Implicated in the development of aplastic anemia. See also arsenic.

ARSYSODILA. See sodium cacodylate.

ARTHRYTIN. See amidoxyl benzoate.

ARTIFICIAL ALMOND OIL. See benzaldehyde.

ARTIFICIAL GUM. See dextrin.

ASBESTOS PARTICLES. Syns: *asbestos dust*, *amosite*, *amphibole*.

THR = MOD via inhal route. A recog (+) carc. [3, 6, 102] The essential lesion produced by asbestos dust is a diffuse fibrosis which probably begins as a "collar" about the terminal bronchioles. Usually, at least 4 to 7 years of exposure are required before a serious degree of fibrosis results. There is apparently less predisposition to tuberculosis than is the case with silicosis. Prolonged inhal can cause cancer of the lung, pleura and peritoneum, and has exper produced cancers of the peritoneum, intestine, bronchus and oropharynx. [80, 3, 6, 23] Clinically,

the most striking sign is shortness of breath of gradually increasing intensity, often associated with a dry cough. In the early stages physical signs are absent or slight; in the later stages rales may be heard, and in long standing cases there is frequently clubbing of the fingers. In early stages of the disease the chest x-rays reveal a groundglass or granular change, chiefly in the lower lung fields; as the condition progresses the heart outline becomes "shaggy," and irregular patches of mottled shadowing may be seen. "Asbestos bodies" may be found in the sputum. At autopsy, the pleurae are thickened and adherent and thick subpleural fibrous plaques are often present. Where the disease is far advanced there are usually large areas of fibrosis, with emphysematous changes in the apices and bases. The alveolar walls are thickened, and the characteristic "asbestos bodies" are found. A common air contaminant. [45]

ASBESTOS, BLUE. See asbestos particles.

ASBESTOS, BROWN (AMOSITE). See asbestos particles.

ASBESTOS, WHITE. See asbestos particles.

ASCARIDOLE. Syn: *ascarisin*. Unstable liquid.

$\text{C}_{10}\text{H}_{16}\text{O}_2$, mw: 168.2, mp: 3.3° , bp: 40° @ 2 mm; 115° @ 15 mm, d: 1.011 @ $13^\circ/15^\circ$.

THR = HIGH oral systemic. An exper neo. [3] See oil of chenopodium and peroxides, organic.

Fire Hazard: Mod, by spont chemical reaction. An oxidizer.

Explosion Hazard: Explodes when heated above 130° or when exposed to organic acids.

Disaster Hazard: Dangerous; when heated, emits toxic fumes and may explode; reacts with reducing materials.

ASCARISIN. See ascaridole.

ASCORBIC ACID. Syns: *l-ascorbic acid*, *vitamin C*.

White crystals, sol in water, slightly sol in alcohol, insol in ether, chloroform, benzene, petroleum ether, oils and fats. $\text{OCOCOH:COHCHCHOHCH}_2\text{OH}$, mw: 176, mp: 192° .

Acute tox data: iv LD_{50} (mouse) = 518 mg/kg. [3]

THR = MOD via iv route. A chemical preservative food additive and a dietary supplement food additive. [109]

ASCORBYL PALMITATE. A white or yellowish white powder, citrus-like odor, sol in alcohol, animal and vegetable oils, slightly sol in water. $\text{C}_{22}\text{H}_{38}\text{O}_7$, mw: 414, mp: 116° - 117° .

THR = No data. Probably LOW to MOD. A chemical preservative food additive. [109]

DIMETHYL-4-(5'-QUINOLYL-1'-OXIDE AZO) ANILINE.

THR = An exper carc. [23]

DIMETHYL-4-(6'-QUINOLYL-1'-OXIDE AZO) ANILINE.

THR = An exper carc. [23]

DIMETHYL-4-(5'-QUINOXALYL AZO)ANILINE.

THR = An exper carc. [23]

DIMETHYL-4-(6'-QUINOXALYL AZO)ANILINE.

THR = An exper carc. [23]

DIMETHYL-4-(2'-QUINOXALYL AZO)ANILINE.

THR = An exper carc. [23]

7,8-DIMETHYL-10-(1-d-RIBITYL)ISOALLOXAZINE. See riboflavin.

DIMETHYLSEBACATE. Syn: *methyl sebacate*. Liquid. $[(CH_2)_4CO_2CH_3]_2$, mw: 230.3, mp: 38°, bp: 293.5°, flash p: 293°F, d: 0.986 @ 30°/25°, vap. press: 1 mm @ 104.0°, vap. d: 7.95.

THR = See esters and methyl alcohol.

Fire Hazard: Slight, when exposed to heat or flame; can react with oxidizing materials.

To Fight Fire: Foam, CO₂, dry chemical.

DIMETHYLSELENIDE. Syn: *methylselenide*. Liquid. (CH₃)₂Se, mw: 109.0, bp: 58°, d: 1.4077 @ 14.6°/4°, vap. d: 3.75.

Acute tox data: ip LD₅₀ (rat) = 552 mg/kg. [3]

THR = MOD via ip route. See selenium and its compounds.

Fire Hazard: Dangerous, when exposed to heat or flame.

Explosion Hazard: U.

Disaster Hazard: Dangerous; see selenium; will react with water, steam, acid or acid fumes to produce toxic fumes; can react vigorously with oxidizing materials.

To Fight Fire: Foam, CO₂, dry chemical.

DIMETHYLSILICANE. Gas. H₂Si(CH₃)₂, mw: 60.1, d: 0.68 @ -80°, mp: -150°, bp: -20°.

THR = See silanes.

N,N-DIMETHYLSTILBENAMINE. C₁₆H₁₇N, mw: 223.3.

THR = An exper carc. [3]

N,N-DIMETHYLSTILBENAMINE (trans).

THR = An exper carc. [3, 23] via oral route.

N,N-DIMETHYLSTILBENAMINE (cis).

THR = An exper neo. [3]

DIMETHYL SULFATE. Syn: *methyl sulfate*. Colorless, odorless liquid. (CH₃)₂SO₄, mw: 126.13, mp: -31.8°, bp: 188°, flash p: 182°F (OC), d: 1.3322 @ 20°/4°, vap. d: 4.35, autoign. temp.: 370°F.

Acute tox data: Oral LD₅₀ (rat) = 440 mg/kg; sc LD₅₀

(rat) = 100 mg/kg; inhal LC₅₀ (human) = 97 ppm for 10 min. [3]

THR = HIGH via oral, sc and inhal routes. Contact of the skin and mu mem with the liquid or vapor, even for short periods, results in intense irr of these tissues several hours later. There is no odor or initial irr to give warning of exposure. On brief, mild exposures, conjunctivitis, catarrhal inflammation of the mu mem of the nose, throat, larynx and trachea and possibly some reddening of the skin develop after the latent period. With longer, heavier exposures, the cornea shows clouding, the irr changes to the nasopharynx are more marked and after 6 to 8 hrs pulmonary edema may develop. Death may occur in 3 or 4 days. The liver and kidneys are frequently damaged. Spilling of the liquid on the skin can cause ulceration and local necrosis. The fatal conc for cats and monkeys is in the range of 25 to 200 ppm of the vapor in air. After a latent period of several hrs, there is severe lacrimation, conjunctivitis, photophobia, coughing and hoarseness, followed, in the case of more severe exposures, by chest pain, dyspnea, cyanosis and possibly death. In patients surviving severe exposures, there may be serious injury of the liver and kidneys, with suppression of urine, jaundice, albuminuria and hematuria appearing. Death, resulting from the kidney or liver damage, may be delayed for several weeks. An exper (S) human carc. [10, 14, 23] Also an exper carc. [3]

Fire Hazard: Mod, when exposed to heat, flame or oxidizers.

Spont Heating: No.

Disaster Hazard: Dangerous; see sulfates. Can react with oxidizing materials. Violent reaction with NH₄OH, NaN₃. [19]

To Fight Fire: Water, foam, CO₂, dry chemical.

DIMETHYL SULFIDE. See methyl sulfide.

DIMETHYL SULFITE. See methyl sulfite.

2,4-DIMETHYL SULFOLANE. Solid. C₆H₁₂SO₂, mw: 148.22, bp: 280°, flash p: 290°F (OC), d: 1.1362 @ 20°/4°, vap. press: 0.006 mm @ 20°.

Acute tox data: Oral LD₅₀ (mouse) = 140 mg/kg; oral LD₅₀ (rabbit) = 115 mg/kg. [3]

THR = HIGH via oral route.

Fire Hazard: Slight, when exposed to heat or flame.

Disaster Hazard: Dangerous; see sulfates; can react with oxidizing materials.

To Fight Fire: Water, foam, CO₂, dry chemical.

DIMETHYL SULFOXIDE. Syn: *DMSO*. Clear, water white, hygroscopic liquid. (CH₃)₂SO, mw: 78.1, mp: 18.5°, bp: 189°, flash p: 203°F (OC), d: 1.100 @ 20°,

XANTHINE. $C_5H_4O_2N_4$, mw: 152.1.

Acute tox data: ip LD_{50} (mice) = 500 mg/kg. [3]

THR = HIGH via ip route. An exper neo. [3] via sc and imp routes.

XANTHINE-N-OXIDE. $C_5H_4O_3N_4$, mw: 168.1.

THR = An exper carc [3] via sc route.

XANTHOGEN DISULFIDE.

THR = Details U. See sulfides.

XANTHURIC ACID. $C_{10}H_7O_4N$, mw: 205.2.

THR = An exper neo [3] via imp route.

XENON. Colorless, gaseous element. Xe, atwt: 131.30, d(gas): 5.8878 g/liter, d(liquid): 3.52 @ -109° , mp: -112° , bp: -107° .

THR = A simple asphyxiant. For a discussion of toxicity effects, argon. A common air contaminant.

Radiation Hazard: For permissible levels, see Section 5A, Table 5A.5. Artificial isotope ^{133}Xe , $T_{1/2}$ = 5.3 d, decays to stable ^{133}Cs via β 's of 0.35 MeV; emits γ 's of 0.08 MeV. Artificial isotope ^{135}Xe , $T_{1/2}$ = 9h, decays to radioactive ^{135}Cs via β 's of 0.91 MeV; emits γ 's of 0.25 MeV. ^{133}Xe and ^{135}Xe are produced by neutron irradiation of stable Xe in air-cooled reactors.

XENON DIFLUORIDE. Colorless solid, stable at room temp., easily sublimed, has a significant vapor pressure at 20° , colorless, water-sol vapor with a powerful fluorine odor. XeF_2 , mw: 169.3, mp: 140° , vap. press: 3.8 mm @ 25° , d(solid): 4.32.

THR = HIGH toxicity corrosive irr to skin, eyes and mu mem. See also fluorides. Its vapor hydrolyzes to form highly toxic hydrofluorides. Must be stored and handled as a very powerful fluorine type of oxidizer. In the presence of even traces of moisture, it will attack glass and metals. See hydrofluoric acid and fluorides.

XENON HEXAFLUORIDE. XeF_6 , mw: 245.3.

THR = Has reacted explosively with water. [19]

HIGH toxicity corrosive irr to skin, eyes and mu mem. See also fluorine and fluorides.

XENYLAMINE. See *p*-aminodiphenyl.

XENYLAMINE ANTI-OXIDANT.

THR = A recog carc. [14] See aromatic amines.

X-RAY FILM(NITROCELLULOSE BASE). See nitrates.

X-RAY FILM SCRAP(NITROCELLULOSE BASE).

See nitrates.

X-RAY FILM(NITROCELLULOSE BASE) EXPOSED. See nitrates.

X-RAYS. Highly penetrating electromagnetic radiation produced by electrical means or by nuclear fission. Radiation Hazard: A recog carc. [14] See radiation and gamma rays.

X-RAY, PRIMARY PROTECTIVE EQUIPMENT NEEDS. See Section 5A.

X-RAY, SECONDARY PROTECTIVE EQUIPMENT NEEDS. See Section 5A.

***m*-XYLENE.** Syn: *m*-xylol. Colorless liquid. $C_6H_4(\text{CH}_3)_2$, mw: 106.2, mp: -47.9° , bp: 110.6° , uel = 7.0%, flash p: 84°F , d: 0.864 g/ml, vap press: 10 mm @ 28.3° , vap. d: 3.66 @ $20^\circ/4^\circ$, temp.: 986°F .

Acute tox data: Oral LD_{50} (rat) = 5000 mg/kg.

$LC_{1.0}$ (rat) = 8000 ppm for 4 hrs; ip LD_{50} (rat) = 2000 mg/kg; sc LD_{50} (rat) = 5000 mg/kg.

THR = MOD via oral, inhal, ip and sc. A common air contaminant.

Fire Hazard: Dangerous, when exposed to flame; can react with oxidizing materials.

Explosion Hazard: Mod, in the form of vapor exposed to heat or flame.

Disaster Hazard: Dangerous; keep away from flame.

To Fight Fire: Foam, CO_2 , dry chemical.

***o*-XYLENE.** Syn: *o*-xylol. Colorless liquid. $C_6H_4(\text{CH}_3)_2$, mw: 106.2, bp: 144.4° , fp: -25.1° , uel = 1.0%, uel = 6.0%, flash p: 90°F , d: 0.880 @ $20^\circ/4^\circ$, vap. press: 10 mm @ 32.0° , 3.66, autoign. temp.: 869°F .

Acute tox data: Oral LD_{50} (rat) = 5000 mg/kg.

LD_{50} (rat) = 1500 mg/kg; sc LD_{50} (rat) = 2000 mg/kg; inhal $LC_{1.0}$ (mice) = 6920 ppm.

THR = MOD via oral, ip, sc and inhal. A common air contaminant.

Fire Hazard: Dangerous, when exposed to flame; can react with oxidizing materials.

Explosion Hazard: Slight, in the form of vapor exposed to heat or flame.

To Fight Fire: Foam, CO_2 , dry chemical.

Disaster Hazard: Dangerous; shock will explode them; when heated, they emit highly toxic fumes of chlorides; they can react with reducing materials.

To Fight Fire: Water or foam.

PERCHLORIC ACID. Colorless; fuming, unstable liquid. HClO_4 , mw: 100.47, mp: -112° , bp: 19° @ 11 mm, d: 1.768 @ 22° .

THR = VERY irr to skin, eyes and mu mem. HIGH via oral and inhal routes.

Fire Hazard: See perchlorates.

Explosion Hazard: See perchlorates. React violently with acetic acid, (acetic acid + acetic anhydride), acetic anhydride, alcohols, (aniline + HCHO), Sb compounds, Bi, cellulose, charcoal, dibutyl sulfoxide, ethyl ether, dimethyl sulfoxide, F_2 , (PbO + glycerine), glycolethers, glycols, HI, HCl, H_2 , P_2O_5 , hypophosphites, ketones, CH_3OH , NI_3 , nitrosophenol, paper, (P_2O_5 + CHCl_3), NaI, steel, sulfoxides, H_2SO_4 , SO_3 , wood. [19] The anhydrous form can explode spont.

Disaster Hazard: See perchlorates.

PERCHLORIC ACID DIHYDRATE. See perchloric acid (over 72%).

PERCHLORIC ACID, MONOHYDRATE. Syn: *hydronium perchlorate*. Fairly stable needles. $\text{HClO}_4 \cdot \text{H}_2\text{O}$, mw: 118.48, mp: 50° , bp: explodes @ 110° , d: 1.88, d. liq: 1.776 @ 50° .

THR = See perchloric acid, sulfuric acid, and perchlorates.

PERCHLORIC ACID (NOT OVER 72%). Clear liquid. $\text{HClO}_4 \cdot 3\text{H}_2\text{O}$, mw: 154.5, mp: -18° , bp: 200° , d: 1.5967 @ $25^\circ/4^\circ$.

THR = See perchloric acid.

PERCHLORIC ACID (OVER 72%). Syn: *perchloric acid dihydrate*. Stable liquid. $\text{HClO}_4 \cdot 2\text{H}_2\text{O}$, mw: 136.5, mp: -17.8° , bp: 200° , d: 1.729 @ $25^\circ/4^\circ$.

THR = See perchloric acid.

PERCHLOROBENZENE. See hexachlorobenzene.

PERCHLOROETHYLENE. Syns: *tetrachloroethylene*, *ethylene tetrachloride*, *carbon dichloride*. Colorless liquid, chloroform-like odor. CCl_2CCl_2 , mw: 165.82, mp: -23.35° , bp: 121.20° , flash p: none, d: 1.6311 @ $15^\circ/4^\circ$, vap. press: 15.8 mm @ 22° , vap. d: 5.83.

Acute tox data: Inhal TC_{LO} (human) = 230 ppm \rightarrow systemic effects; inhal TC_{LO} (man) = 280 ppm for 2 hrs \rightarrow eye effects; inhal TC_{LO} (man) = 600 ppm for $\frac{1}{8}$ hr \rightarrow CNS effects; oral LD_{LO} (dog) = 4000 mg/kg; sc LD_{LO} (rabbit) = 2000 mg/kg; iv LD_{LO} (dog) = 85 mg/kg. [3]

THR = MOD via inhal, oral, sc, ip and dermal routes. HIGH via iv route. Not corrosive or dangerously reactive, but toxic by inhal, by prolonged or re-

peated contact with the skin or mu mem, c ingested by mouth. The liquid can cause to the eyes; however, with proper precau can be handled safely. The symptoms of a toxication from this material are the resul effects upon the nervous system.

Exposures to higher conc than 200 ppm irr, lachrymation and burning of the eyes of the nose and throat. There may be vc nausea, drowsiness, an attitude of irrespon and even an appearance resembling alcoholic cation. This material also acts as an ane through the inhalation of excessive amount: a short time. The symptoms of fatal into: are irritation of the eyes, nose and thro: fullness in the head, mental confusion; the be headache stupefaction, nausea and vc personnel suffering from subacute poisoni suffer from such symptoms as headache, nausea, vomiting, mental confusion and ten blurring of the vision. This can occur wher quate ventilation results in concentrations than 200 ppm, or where the vapor conc a mittedly high due to faulty handling of the n or when an individual fails to take adequ cautionary measures.

This material can cause dermatitis, part after repeated or prolonged contact with t The dermatitis is preceded by a reddening ar ing and more rarely, a blistering of the skin event, the skin becomes rough and dry, due to the removal of skin oils by material. T then cracks easily and is readily susceptib: fection (Section 9). Upon ingestion it caus the gastrointestinal tract, which, in turn. nausea, vomiting, diarrhea and bloody stool: ever, such effects are usually less severe thar fects of swallowing similar amounts of oth: rinated hydrocarbons.

It may be handled in the presence or abs air, water, and light with any of the comm: struction materials at temp. up to 140°C . Th: rial is extremely stable and resists hydro: common air contaminant. Reacts violen Ba, Be, Li. [19]

Disaster Hazard: Dangerous; when heated to: it emits high tox fumes of chlorides.

PERCHLOROMETHYL MERCAPTAN. Syn: *carbonyl tetrachloride*, *trichloromethane chloride*. Yellow oily liquid. CHSCl_3 , mw: 1: slight decomp @ 149° , d: 1.700 @ 20° , vap. Acute tox data: Inhal TC_{LO} (human) = 45 p eye effects; inhal LC_{LO} (human) = 483 p

HYDROCYANIC ACID SOLUTION. See hydrocyanic acid.

HYDROCYANIC ACID, UNSTABILIZED. See hydrocyanic acid.

HYDROFERROCYANIC ACID. White crystalline material. $\text{H}_4\text{Fe}(\text{CN})_6$, mw: 216.

THR = See ferrocyanides.

HYDROFLUORIC ACID. Syns: *hydrogen fluoride*, *fluorohydric acid*. Clear, colorless, fuming corrosive liquid or gas. HF, mw: 20.01, mp: -83.1° , bp: 19.54° , d: 0.901 g/liter (gas); 0.699 @ 22° (liquid), vap. press: 400 mm @ 2.5° .

Acute tox data: Inhal TC_{Lo} (human) = 32 ppm for 1 min; inhal TC_{Lo} (human) = 110 ppm for 1 min; inhal LC_{50} (rat) = 1276 ppm for 1 hr. [3]

THR = HIGH irr to skin, eyes and mu mem and via oral route. [84] It is extremely irr and corrosive to the skin and mu mem. Inhal of the vapor may cause ulcers of the upper respiratory tract. Conc of 50–250 ppm are dangerous, even for brief exposures. Hydrofluoric acid produces severe skin burns which are slow in healing. The subcutaneous tissues may be affected, becoming blanched and bloodless. Gangrene of the affected areas may follow. See also fluorides. It is a common air contaminant. [84, 57, 85, 86] Violent reaction with As_2O_3 , P_2O_5 , acetic anhydride, 2-amino ethanol, NH_4OH , H_2BiO_3 , CaO , chlorosulfonic acid, ethylene diamine, ethylene imine, F_2 , (HNO_3 + lactic acid), oleum, β -propiolactone, propylene oxide, Na, NaOH, H_2SO_4 , vinyl acetate. [19]

Disaster Hazard: Dangerous; when heated, emits highly corrosive fumes of fluorides; will react with water or steam to produce toxic and corrosive fumes.

HYDROFLUORIC ACID, ANHYDROUS. See hydrofluoric acid.

HYDROFLUORIC AND SULFURIC ACIDS, MIXTURES. See components.

HYDROFLUOSILICIC ACID. Syns: *fluosilicic acid*, *silicofluoric acid*. Transparent, colorless, fuming liquid. H_2SiF_6 , mw: 144.08, bp: decomp.

Acute tox data: Oral LD_{Lo} (guinea pig) = 200 mg/kg; sc LD_{Lo} (guinea pig) = 250 mg/kg. [3]

THR = HIGH irr to skin, eyes and mu mem and via inhal route.

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic and corrosive fumes of fluorides; will react with water or steam to produce toxic and corrosive fumes.

HYDROFURAMIDE. Syns: *n,n'*-difurfurylidene-2-furan methane diamine, *furfuramide*. Light brown

crystals. $(\text{C}_4\text{H}_3\text{OCH})_3\text{N}_2$, mw: 268.26, mp: 117° , bp: 250° decomp.

Acute tox data: Oral LD_{50} (rat) = 40 mg/kg; oral LD_{50} (mouse) = 950 mg/kg. [3]

THR = HIGH irr to skin, eyes and mu mem and via oral route. A component of fungicides. Causes intense pulmonary irr and reported to cause liver and kidney damage. See also amines and amides.

Disaster Hazard: Slight; when heated to decomp, emits toxic fumes of NO_x .

HYDROGEN. Colorless gas. H_2 , mw: 2.0162, mp: -259.18° , bp: -252.8° , lel = 4.1%, uel = 74.2%, d: 0.0899 g/liter, autoign. temp.: 752°F , vap. d: 0.069. THR = Practically NONE.

Radiation Hazard: For permissible levels, see Section 5A, Table 5A.5. Artificial and natural isotope ^3H (tritium), $T_{1/2}$ = 12.3y, decays to stable ^3He via β 's of 0.019 MeV. Tritium occurs naturally as a result of cosmic ray bombardment of ^2H .

Fire Hazard: Highly dangerous, when exposed to heat, flame or oxidizers.

To Fight Fire: Stop flow of gas.

Explosion Hazard: Severe, when exposed to heat or flame. Violent reaction with (air + Pt), Br_2 , Cl_2 , ClF_3 , (dioxane + Ni), F_2 , Li, (Mg + CaCO_3), nitroanisole, NF_3 , OF_2 (Pd + isopropyl alcohol), 3-methyl-2-penten-4-yn-1-ol. [19]

Disaster Hazard: Dangerous; can react vigorously with oxidizing materials.

HYDROGEN ANTIMONIDE. See antimony hydride.

HYDROGEN ARSENIDE (GAS). See arsine.

HYDROGEN AZIDE. See hydrazoic acid.

HYDROGEN BISMUTHIDE. Syn: *bismuthine*. Liquid. H_3Bi , mw: 212.02, bp: 22° .

THR = See bismuth compounds and hydrides.

HYDROGEN BROMIDE. See hydrobromic acid.

HYDROGEN BROMIDE (CONSTANT BOILING MIXTURE). Colorless liquid. $\text{HBr}(47\%) + \text{H}_2\text{O}$; mp: -11° , bp: 126° , d: 1.49.

THR = See hydrobromic acid.

HYDROGENBROMIDE, HYDRATED. Colorless liquid. $\text{HBr} \cdot \text{H}_2\text{O}$, mw: 98.94, bp: -3.3° to -15° , d: 1.78.

THR = See hydrobromic acid.

HYDROGEN CARBOXYLIC ACID. See formic acid.

HYDROGEN CHLORIDE. See hydrochloric acid.

HYDROGEN CYANIDE. See hydrocyanic acid.

HYDROGEN DIOXIDE. See hydrogen peroxide.

HYDROGEN DIPHOSPHIDE. HP_2 , mw: 63.

THR = Ignites @ 100° or by impact. [19] HIGH via oral route. See also phosphides.

xylene. $(C_2H_5O)_2P(S)SCH_2SC_2H_5$, mw: 260, bp: 118°–120° @ 0.8 mm, d: 1.156.

Acute tox data: Oral LD₅₀ (rat) = 1 mg/kg; dermal LD₅₀ (rat) = 3 mg/kg; oral LD₅₀ (wild birds) = 1 mg/kg. [3]

THR = VERY HIGH via oral and dermal routes. A cholinesterase inhibitor, see parathion. An insecticide. A food additive permitted in the feed and drinking water of animals and/or for the treatment of food-producing animals. [109]

Disaster Hazard: See parathion.

PHORBOL. $C_{20}H_{27}O_6$, mw: 363.5.

THR = An exper carc. [3, 23]

PHORBOL ACETATE CAPRATE. $C_{32}H_{48}O_8$, mw: 560.8.

THR = An exper neo. [3]

PHORBOL ACETATE LAURATE. $C_{33}H_{52}O_8$, mw: 576.9.

THR = An exper neo. [3]

PHORBOL ACETATE MYRISTATE. $C_{35}H_{56}O_8$, mw: 604.9.

THR = An exper neo. [3]

PHORBOL CAPRATE + 2-METHYL BUTYRATE. $C_{34}H_{56}O_8$, mw: 592.9.

THR = An exper neo. [3]

PHORBOL CAPRATE TIGLATE. $C_{34}H_{52}O_8$, mw: 588.9.

THR = An exper neo. [3]

PHORBOL DIACETATE.

THR = An exper carc. [23]

PHORBOL DIBENZOATE.

THR = An exper carc. [23]

PHORBOL DIDECANOATE.

THR = An exper carc. [23]

PHORBOL LAURATE + METHYL BUTYRATE.

$C_{36}H_{58}O_8$, mw: 618.9.

THR = An exper neo. [3]

PHORBOL MYRISTATE ACETATE.

See phorbol acetate myristate.

PHORONE. Syn: 2,6-dimethyl-2,5-heptadien-4-one.

Solid or greenish liquid. $(CH_3)_2CCHCOCHC(CH_3)_2$, mw: 138.20, mp: 28°, bp: 197.2°, flash p: 185°F (OC), d: 0.879, vap. press: 1 mm @ 42.0°, vap. d: 4.8.

THR = Tox. See also isophorone.

Fire Hazard: Mod, when exposed to heat or flame; can react with oxidizing materials.

To Fight Fire: Foam, CO₂, dry chemical.

"PHOSDRIN." See dimethyl-1-carbomethoxy-1-propen-2-yl phosphate.

PHOSGENE. Syns: carbon oxychloride, carbonyl chloride, CG. Colorless gas or volatile liquid, odor of new

mown hay or green corn. COCl₂, mw: 98.92, mp: -118°, bp: 8.3°, d: 1.37 @ 20°, vap. press: 1180 mm @ 20°, vap. d: 3.4.

Acute tox data: Inhal LC₅₀ (human) = 3200 mg/m³; inhal TC_{LO} (human) = 25 ppm for ½ hr → irr effects; inhal LC₅₀ (mice) = 110 ppm for ½ hr; inhal LC₅₀ (monkey) = 1087 ppm for 1 min; inhal LC₅₀ (rat) = 1482 ppm for 1 min; inhal LC₅₀ (rabbit) = 3211 ppm for 1 min; inhal LC₅₀ (guinea pig) = 141 ppm for ½ hr. [3]

THR = HIGH via inhal route. HIGH irr to eyes and mu mem. [72, 73, 74] In the presence of moisture, phosgene decomp to form hydrochloric acid and carbon monoxide. This action takes place within the body, when the gas reaches the bronchioles and the alveoli of the lungs. There is little irr effect upon the respiratory tract, and the warning properties of the gas are therefore very slight. The liberation of hydrochloric acid in the lung tissues results in the development of pulmonary edema, which may be followed by bronchopneumonia, and occasionally lung abscess. Degenerative changes in the nerves have been reported as later sequelae. Conc of 3–5 ppm of phosgene in air cause irr of the eyes and throat, with coughing; 25 ppm is dangerous for exposure lasting 30–60 min, and 50 ppm is rapidly fatal after even short exposure. There may be no immediate warning that dangerous conc of the gas are being breathed. After a latent period of 2–24 hrs, the patient complains of burning in the throat and chest, shortness of breath and increasing dyspnea. There may be moist rales in the chest. Where the exposure has been severe, the development of pulmonary edema may be so rapid that the patient dies within 36 hrs after exposure. In cases where the exposure had been less, pneumonia may develop several days after the occurrence of the accident. In patients who recover, no permanent residual disability is thought to occur. A common air contaminant. Reacts violently with Al, *tert*-butyl azido formate, 2,4-hexadiyn-1,6-diol, isopropyl alcohol, K, Na. [19]

Disaster Hazard: Highly dangerous; when heated to decomp, or on contact with water or steam, will react to produce toxic and corrosive fumes.

PHOS-KIL. See parathion.

PHOSPHAM. White amorphous crystals. PN₂H, mw: 60.00.

THR = U. Reacts violently with air, CuO, HgO, NO₂, nitrates. [19]

Disaster Hazard: Dangerous; on decomp, emits highly toxic fumes of phosphorus and nitrogen compounds.

PHOSPHAMIDON. See 2-chloro-2-diethylcarbamoyle-1-methyl vinyl dimethyl phosphate.